WORLD PETROLEUM

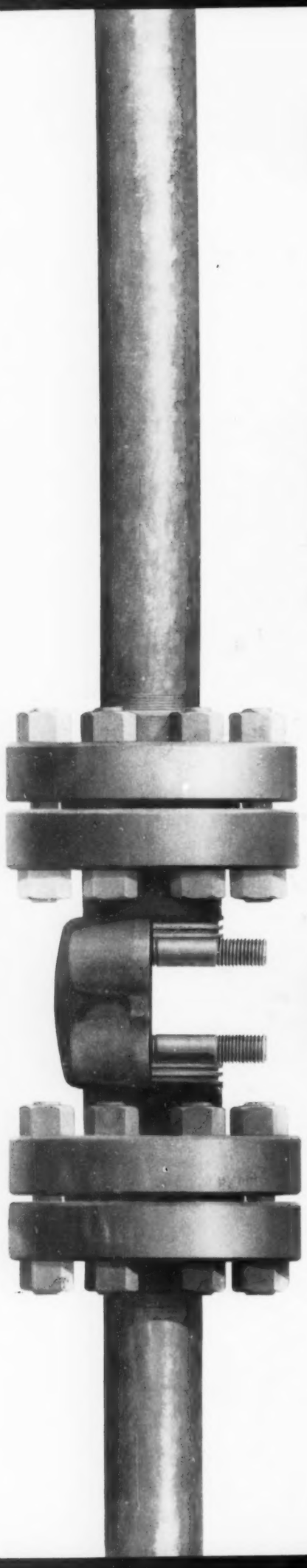
OCTOBER 1957

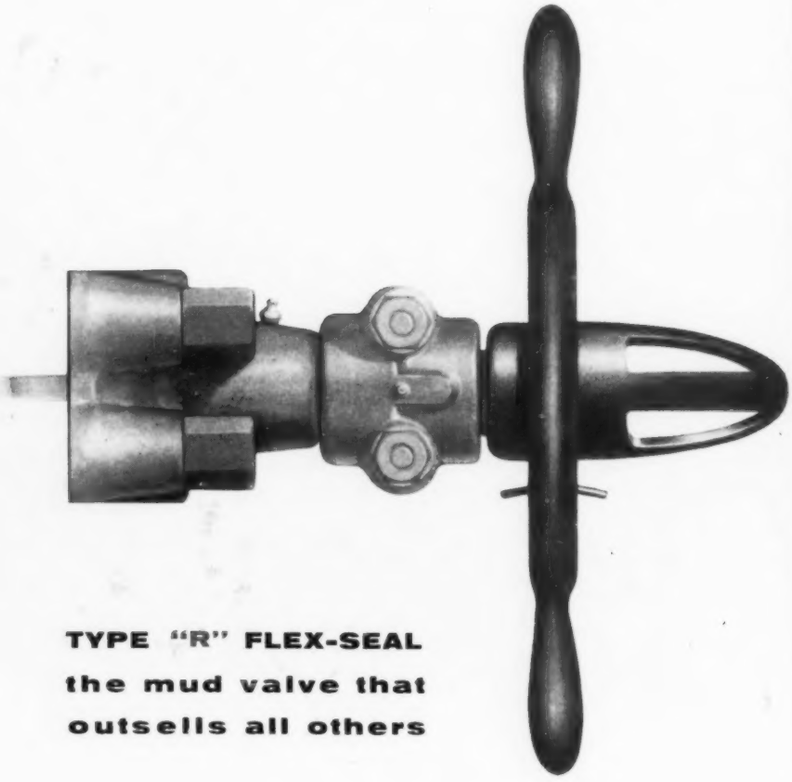
ten dollars per year
one dollar per copy

table of contents page 2

STAYS RIGID DURING REPAIRS

The Type "R" Flex-Seal Mud Valve is bringing more benefits to operators in every oil producing area. One of the reasons is that it cannot get out of alignment during repairs. Simply unscrew the four thread protecting cap nuts—the new, tough, special compound packer and oversize wear rings lift straight out as a unit. You don't have to break the line to change an insert. Integral welded subs and bonnet cap make misalignment during repairs impossible. If a sub should be sand cut, it may be separated and replaced without buying an expensive valve body. Gate replacement requires no special fixtures, no intricate thread timing. For longest wear and easiest repair, COUNT ON CAMERON Type "R" Flex-Seals, the safe, economical mud valve.





TYPE "R" FLEX-SEAL
the mud valve that outsells all others

Cameron
IRON WORKS, INC.
P. O. Box 1212 - Houston, Texas

Export Office: 7912 Empire State Bldg., New York City. In England: Cameron Iron Works, Ltd., Time & Life Bldg., New Bond Street, London W. 1 England

Current contracts include :—
British Celanese Ltd.,
Imperial Chemical Industries Ltd.,
Brymbo Steel Works Ltd.,
Stewarts and Lloyds Ltd.,
Steel Company of Wales Ltd.

Makers since 1790 of :—
Railway and other bridges ;
Constructional steelwork ;
Unit bridging ; Iron paving ;
Wrought iron bars ;
Overhead cranes ; Railway wagons and mine cars ;
Meehanite castings ; Mining and sheet metal machinery ;
Sewage injectors and pumps ;
Wool washing machinery ;
Aglite lightweight aggregate ;
High quality bricks.

ORE and ADMIRATION

Steelmen, however old, never fail to feel — no matter how many times they've seen it — the awe and excitement of a furnace in full blast. From apprentice to Chief Smelter, that amazingly skilled aristocrat of the foundries, the thrill remains as sharp as ever with the sweat and heat and glory of it all.

It is well known by steelmen that high purity oxygen in blast, Bessemer or open hearth makes for considerably greater heat much more cheaply. This oxygen is best produced by Butterley on-site Tonnage Oxygenerators and allows a still wider range of quality steels.

While being compact and efficient, these plants produce a continuous supply of oxygen and/or nitrogen at any desired purity and pressure in any quantity needed where there's work with oxygen afoot.

Sole production and sales rights have been acquired by Butterley from America for U.K., British Commonwealth and certain European countries.

If you can use oxygen, consult

BUTTERLEY

OXYGEN DIVISION

OXYGEN DIVISION, THE BUTTERLEY COMPANY LIMITED, 9 UPPER BELGRAVE STREET, LONDON, S.W.1. TELEPHONE: SLOANE 8172/3

VOL. 28, NO. 11 OCTOBER, 1957

World Petroleum

THE MANAGEMENT PUBLICATION OF THE INTERNATIONAL PETROLEUM INDUSTRY

CONTENTS

4 Washington Pipe Line, *by Joseph B. Huttlinger*

6 Canadian Notes

14 London Letter, *by E. Lawson Lomax*

30 Latin American Oil News

37 Editorial—Who? Me!

38 Photogeology Speeds Libyan Exploration, *by Laurence Brundall*

42 Oil Discoveries in the Amazon Basin, *by Dr. J. E. Rassmuss*

46 The Gabon—A New Oil Province, *by Maurice Moyal*

50 Pipeline Projects in West Germany, *by A. M. Stahmer*

52 New Daura Lube Plant Meets Iraq's National Lube Requirements

55 Newer Uses for Middle Distillates

60 Rocket Fuels Adapted to Formation Fracturing

62 Progress in Well-Completion Methods—Part II: Sand Control and Formation of Well Cavities, *by Lester C. Uren*

70 Review of Recent USA Patents on Petrochemicals—Preparation and Reactions of Olefins, *by Heinz Heinemann and Harold Shalit*

78 International News and Notes

82 Oil Company Changes

THIS MONTH'S COVER

The asphalt plant of American Bitumels and Asphalt Co. shown on the cover is the Portland installation of this wide-spread organization which sells and makes all grades of asphalt from Perth Amboy in New Jersey to San Francisco and from Canada to the Gulf. A wholly-owned subsidiary of Standard Oil Co. of California, the company uses California crudes for the west, Venezuelan crudes for the east. The cover plates are reproduced here through the courtesy of C. R. Lyman, Editor, The Bulletin, house organ of Standard Oil Co. of California.

FOUNDED BY RUSSELL PALMER

Publisher MONA PALMER
Editor Emeritus E. W. MAYO
Editor J. C. CHATFIELD
Managing Editor G. H. BARROWS
Associate Editor ELOISE MICHEL
Production Manager A. V. HARCOURT
Art Director CHARLOTTE BLASS

Member of National Business Publications, Inc., and Business Publications Audit of Circulation, Inc.

SUBSCRIPTIONS

1 year, $10.00 2 years, $18.00
3 years, $25.00 Single copies $1.00

GENERAL OFFICES

604 Fifth Avenue, New York 20
(Tel. JUdson 6-4820)

BRANCH OFFICES

EUROPEAN OFFICE LONDON, ENGLAND

G. L. Fetherstonhaugh, St. Paul's Corner, Ludgate Hill, London, E.C.4.
(Tel. CITY 5318)

TORONTO 1, ONT., CANADA

Allin Associates 12 Richmond St. East
(Tel. EMpire 4-2001)

Allin Associates 1487 Mountain St.
Montreal P.Q., Canada
(Tel. HArbour 6898)

WASHINGTON, D.C.

J. B. Huttlinger National Press Building
14th and F Streets (Tel. EX3-3733)

LOS ANGELES 14

T. T. Drake 412 West Sixth St. (Tel. MUtual 1391)

NEW YORK 20

Sales Representative
E. L. Townsend
William H. Knauer
604 Fifth Avenue (Tel. JUdson 6-4820)

TULSA 3

O. F. Cozier, Mid-Continent Advertising Manager, 605 Mayo Bldg. (Tel. Diamond 3-1335)

World Petroleum is published by Mona Palmer, Trustee under the will of Russell Palmer

© Mona Palmer Trustee, 1957

BENCH-SCALE DISTILLATION EQUIPMENT. The Center has various types and sizes of apparatus to distill any size sample from one cc to a tank-car load.

Unique Lummus Engineering Development Center—30 Minutes from Manhattan—Proves Out Processes Before Construction

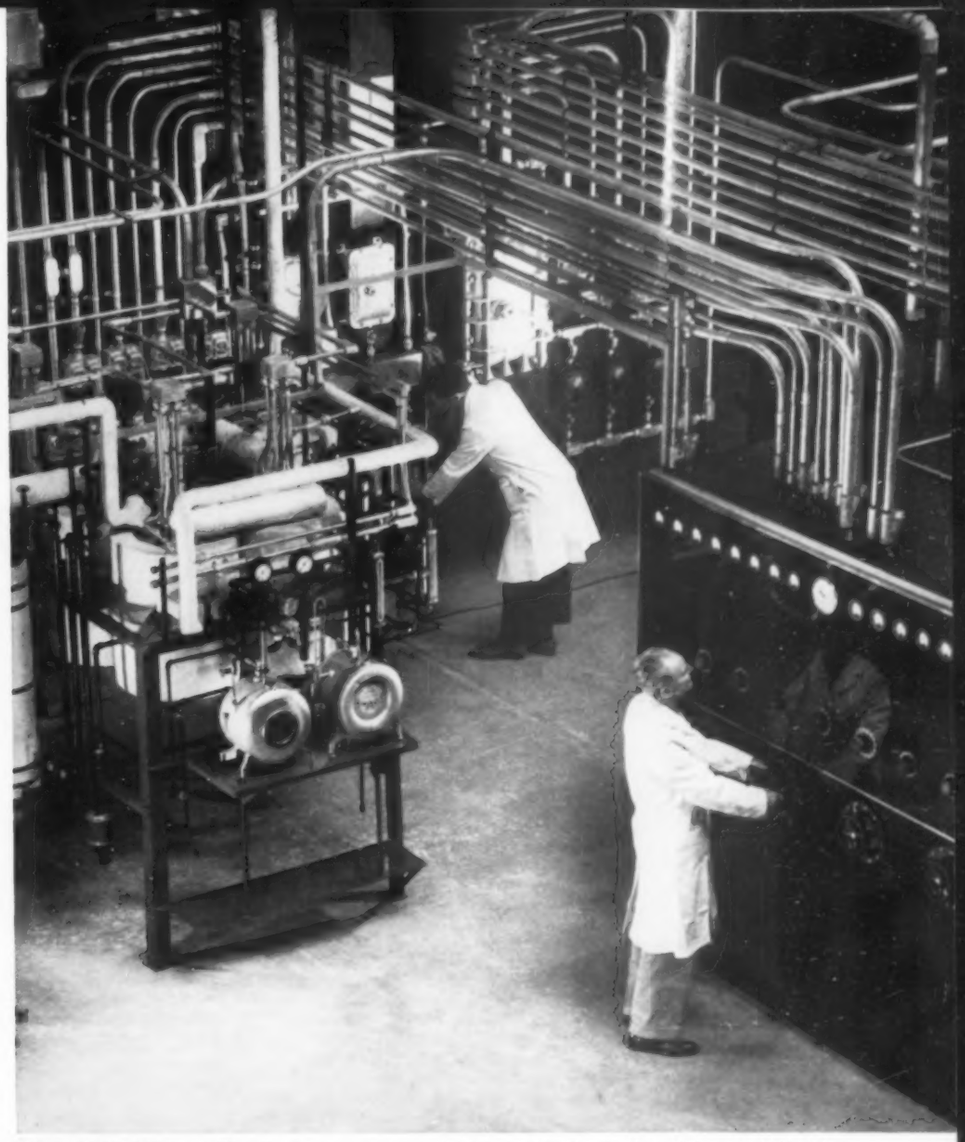
At a new 150,000 square-foot Center near the Newark Airport, the Lummus Company is expanding a long-established engineering development program into a major service to the process industries. The intensive pilot plant investigations carried out here will, in the years to come, spell the difference between rash gamble and sound plant investment for many manufacturers in the chemical, petroleum, pulp and paper and allied fields.

For a complete description of the Center and how it can help you bridge the gap between laboratory research and successful production, write for the 16-page brochure "Lummus Engineering Development Center." Address The Lummus Company, 385 Madison Avenue, New York 17, New York.

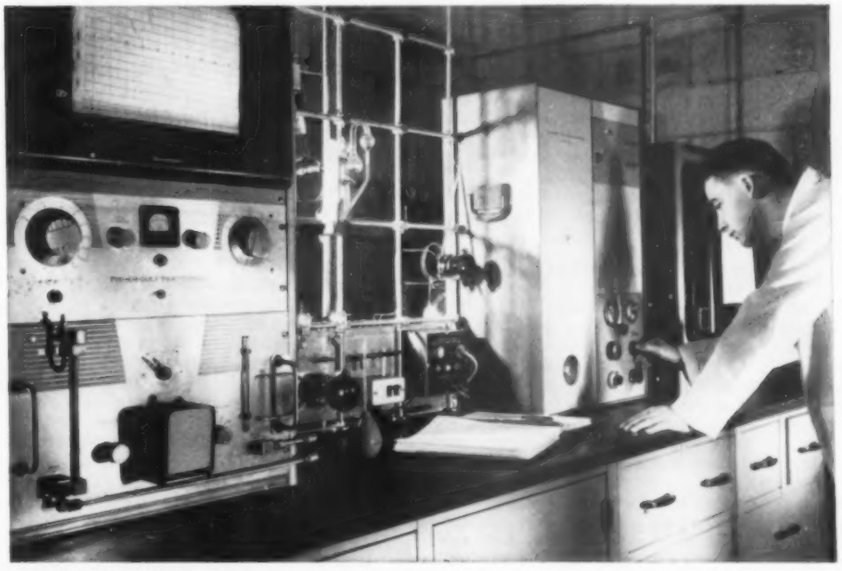
LUMMUS

ENGINEERS AND CONSTRUCTORS FOR INDUSTRY

NEW YORK • HOUSTON • BATON ROUGE • CHICAGO • MONTREAL
CARACAS • LONDON • PARIS • THE HAGUE • BOMBAY



MOST PILOT UNITS at The Center are put together from standard "building blocks." Skid-mounted charging units such as the one at left hold tanks, heaters and pumps for transfer and metering. Process equipment, here shown in background center, can be widely varied. At right is electrical control cabinet. All switches, relays and controls not housed in explosion-proof boxes are enclosed in cabinets like this one, pressurized with outside air to exclude process vapors.



ANALYSIS OF MATERIALS processed and produced in pilot operations at The Center is an important part of the work carried out by Lummus engineers. Here a laboratory technician determines the composition of a multiple-component gas, using a gas chromatography technique.

WORLD PETROLEUM FOR OCTOBER 1957, Vol. 28, No. 11, October, 1957. WORLD PETROLEUM is published monthly by Mona Palmer, Trustee under the will of Russell Palmer, Emmett Street, Bristol, Conn. Editorial and Executive offices, 604 Fifth Avenue, New York 20, N. Y. Accepted as a controlled circulation publication at Bristol, Conn. Subscription rate: $10.00 per year. Single copies $1.00.

Washington PIPE LINE

By Joseph Huttlinger

Little Oil Legislation Passed

The US Congress had rough hearings for petroleum in the session just ended, but it came to very little in the way of new legislation. Extensive hearings into petroleum may result in action next year. In light of what's been happening, here are some areas to watch:

Oil imports—Many persons feel President Eisenhower's voluntary import restriction won't work. So, a drive is under way for a law next year for a hard-and-fast quota limit on oil imports. This, probably, would be added to the Reciprocal Trade Agreements Act, also up for extension next year. Chances are 50-50 for passage of any legislation.

Natural gas—The bill to ease up federal price and other controls over independent producers of gas was put off until next year—after approval by the House Commerce Committee. Action in the House and the Senate will be tried. Outcome is in doubt.

Taxes—Income-tax depletion allowance for oil and gas production will be up for attention in hearings starting in January before House Ways and Means Committee. Overall revision of tax laws is aim of the hearings. Oil will have to defend its 27.5% allowance in the USA; and more difficult for foreign production. Oil-shale producers will seek a 27.5% rate, instead of 15% at present. In-oil payments, and whether they are capital gains or ordinary income, will be studied.

The credit allowed USA oil firms abroad on taxes paid to foreign countries will be up for attention, with many congressmen wanting this restricted drastically.

Oil pipelines—Many bills are due for study. One, backed by some Democratic senators, would forbid a refiner to own a pipeline. Also in regard to pipelines, the Department of Justice may press ahead its study of whether oil lines make more money than allowed by the Elkins consent decree of 1940.

Divorcement—Representative James Roosevelt (D., Calif.), plans more study of his legislation which would forbid refiners to own and operate retail filling stations. Representative John E. Heselton (R., Mass.), plans to push a bill to impose public-utility controls (cost-plus) over petroleum.

Foreign Investment Rising

USA citizens are adding $1.4 billion a year to their investments in petroleum operations outside the United States. US Department of Commerce claims that, at the start of this year, private USA investment abroad was $33 billion, a gain of $4 billion in a year of which half was in the petroleum industry.

Of the total USA private investment abroad, some $22.1 billion is direct investment, and of this some $7.2 billion is in petroleum. By areas, the direct petroleum investment at the end of 1956 was $1.8 billion in Canada, a gain of $400 million; $2.2 billion in Latin America, a gain of $400 million; $1 billion in Western Europe, a gain of $200 million; and $2.3 billion in other areas, a gain of $400 million.

Too Much Oil

Too much oil now is regarded in Washington as the major problem within the industry. Producers, refiners, and marketers are disturbed. Chairman James Roosevelt (D., Calif.), of a House Small Business subcommittee, plans an investigation of the matter starting late this year. Hearings would come next year. He ties this into his studies of gasoline-dealer problems by saying surplus product helps bring on price wars, so injurious to dealers.

Politics Holds Up Alaskan Order

A pickup in oil and gas activity in Alaska is due once Department of the Interior revokes public land order 82. Up to 25 million acres, next to Naval Petroleum Reserve No. 4, will be opened to private development when Interior acts.

Secretary of the Interior Fred Seaton, like his predecessor, Douglas McKay, has been reluctant to move, fearing charges of "giveaway." Democratic members of Congress have refused to share responsibility. If the action comes, it will be by the Republican administration. Backed by the Navy, which runs the petroleum reserves, the administration action is regarded as sensible. Only politics explains in the delay of several years.

Pipeline Revenues

Oil pipeline revenues are rising, but the volumes of oil they carry are rising even faster. Interstate Commerce Commission said so in a recent report.

Thus, revenues of 67 large oil pipelines reporting to ICC were $340,155,167 in the first half of 1057. This is 1.3% higher than the $335,539,338 in the first half of 1956.

The barrels of oil originated and received from connections was 2,282 million in the first half of 1957. This is 5.9% more than the 2,154 million barrels originated in the first half of 1956.

Jet-Fuel Imports Studied

A congressional committee takes a dim view of military purchases of jet fuel from Aruba, rather than from USA plants. Senate Small Business Committee, in a report, said this added to "hardships" on small refiners, and helped reduce the number of small refineries on the West Coast to 18 from 35.

The committee asked the Military Petroleum Supply Agency for a report on total government purchases of petroleum products, broken down between domestic products and foreign products, for the three fiscal years ending last June 30.

Complaint about the Aruba purchases came from George T. Goggin. He is president of the Independent Refiners Assn. of California, and executive vice president of the Douglas Oil Co. of California.

Antitrust Suit Filed

An antitrust suit with worldwide aspects is under way in the justice Department's action against Hughes Tool Co., Houston. Filing suit in the US District Court for the Southern District of New York, DJ claims Hughes entered into agreements with a German firm—Maschinen-und Bohrgeratefabrik Alfred Wirth & Co., of Erkelenz, Germany, which tended to restrict competition.

Deputy Attorney General William Rogers, who filed the action, said that, "by this case, the government is seeking cancellation of certain formal contracts entered into by the defendant which, the complaint alleges, have prevented the importation in the United States of competitive equipment and limited competition in interstate and foreign commerce."

Oil Earns 1.4 Billion Abroad In '56

USA private investment in petroleum abroad during 1956 earned a record of $1,406 million, the Department of Commerce reports.

This was well above the $1.229 million earned in 1955, and above the $1,029 million earned in 1954.

By areas, the 1956 earnings were $25 million in Canada; $597 million in Latin America; $139 million in Western Europe; and $595 million in all other areas.

O'Mahoney Hearings Published

Findings of the Senate Judiciary Subcommittee have been published, and are available through the US Government Printing Office. The content of the report was released earlier, and the final copy does not differ from the early version.

The major recommendations boil down to these:

1. Congress should legislate to limit the 27.5% depletion allowance for crude-oil and gas to production within the USA and its territories.

2. Congress should study whether legislation is needed to prevent too much use of the foreign tax-credit system which reduces income taxes due the USA from firms with overseas operations.

3. Department of Justice should start "a complete study" of Arabian American Oil Co. to see if it illegally restrains commerce. The report said the four owners buy at "monopolistic prices" from Aramco.

4. DJ also should start "an immediate investigation" of 90% ownership of pipeline capacity in the USA by major oil companies. Aim would be to see if there is monopoly to the harm of independent producers and refiners, and to bring crude-oil price discrimination and pipeline proration.

5. Congress should legislate to require industry advisory committees to the government, such as the National Petroleum Council, to have full-time government chairmen and supervision.

6. Congress should require USA firms operating abroad to register with the government all agreements affecting commerce.

7. Congress should consider adding a higher oil import duty to limit crude-oil imports, instead of the White House program calling for voluntary restraint. The White House program is called "unworkable," and a step which preserves rigid market positions of major oil firms.

8. The USA should forbid plans of action such as the Middle East Emergency Committee, although industry groups for fact finding would be helpful in another crisis.

9. Finally, Congress should study and propose a national policy for oil for the consideration of the Congress. This is needed because of troubles in dealing with oil imports, pipeline and tanker transport, crude-oil deficits on the West Coast, and "anticompetitive" results of recent oil-industry programs.

The majority findings often are by but a bare majority. Senator Alexander Wiley (R., Wisc.), wrote one separate report, agreeing with but part of the majority findings. Senator Everett M. Dirksen (R., Ill.), wrote another separate report disagreeing with virtually all the majority findings. And Senator Estes Kefauver (D., Tenn.), who signed the majority report, has "reservations" about ending the 27.5% depletion provision for foreign operations and about a higher import duty to limit crude-oil imports.

Other signers of the majority report were Senators Joseph C. O'Mahoney (D., Wyo.); Thomas C. Hennings (D., Mo.); Matthew M. Neely (D., W. Va.). END

this booklet tells...

OIL and GAS DEPARTMENT
A brief guide to the many, often unique financial services provided by Empire Trust Company to individuals, independent operators, companies and investors in the oil and gas industry.
Empire Trust Company

INDEPENDENTS *and* COMPANIES INTERESTED IN OIL AND GAS OPERATIONS

about Empire's Oil-Loan Policies and Other Financing Services

INVESTORS

about Empire's Drilling Program Supervision • Special Oil and Gas Investment Advisory Activities • Consulting & Appraisal Services—Oil & Gas Properties

Empire Trust Company offers specialized, fully integrated, and – we believe – unique combinations of financial and technical supervisory service. The user of any of our services may benefit from the scope of our activities in all the others.

Empire Trust Company has maintained an active interest in the oil industry for many years. This long-standing association has resulted in a thorough understanding of the industry and its problems. Located in the heart of New York's financial district, the bank is in the closest possible touch with the sources of capital and the most current economic information.

THIS BOOKLET WILL SHOW YOU HOW WE CAN SERVE companies, groups and individuals who are interested in the various ways of investing funds in the oil and gas industry.

We shall be pleased to send, upon request, a copy of this booklet without charge or obligation. Merely write to the address below.

Empire Trust Company

Oil and Gas Department, Division F

20 Broad Street, P. O. Box 98, New York 5, N. Y.

Member Federal Deposit Insurance Corporation

Canadian Notes

Casinghead Gas to Be Utilized

J. H. Brockelbank, Minister of Mineral Resources, has announced the granting of a permit to the Steelmen Gas Ltd., formerly the Provo (Sask.) Ltd., for the gathering, processing, and transmission of casinghead gas in the Steelman area. The $20 million project, which will be constructed northeast of Estevan, is expected to be in operation by September 1958. It will process the casinghead gas —now being flared in excess of 17 million cubic feet per day—into propane, butane, gasoline, sulfur, and dry residue gas. The residue gas will then be sold to the Saskatchewan Power Corp. for use in its natural-gas distribution system.

The terms of the permit provide there will be no export of the gas from the province unless the permission of the Minister of Mineral Resources is first obtained, and that a substantial quantity of propane shall be made available to the Saskatchewan government or its nominee. "This is the largest project to be undertaken in the province for the salvage of gas being wasted," said Mr. Brockelbank. "Other salvage programs are in effect at Smiley Dewar, Coleville, and Success. Action will also be taken in the near future to save the casinghead gas in the Alida-Nottingham area."

Canerpa for Hodag Chemical in Canada

Hodag Chemical Corp., worldwide Chicago-based chemical distributor, has appointed Canerpa Ltd., Montreal, as Canadian representative for its chemical products, antifoams, and other surface-active agents. Canerpa headquarters are at 1117 St. Catherine St. West, Montreal—with a branch in Toronto.

A. E. Ames & Co.

Limited

Government, Municipal

and Corporation Securities

A. E. Ames & Co.

Members

Toronto Stock Exchange

Montreal Stock Exchange

Canadian Stock Exchange

United States Affiliate:

A. E. Ames & Co. Incorporated

New York • Boston

Business Established 1889

Toronto

MONTREAL LONDON, ENG. VANCOUVER VICTORIA
WINNIPEG CALGARY LONDON HAMILTON OTTAWA
KITCHENER ST. CATHARINES OWEN SOUND QUEBEC

Cities Service Toronto Refinery

Cities Service Oil Co. has started construction in Trafalgar Township, west of Toronto, on a 20,000 b/d refinery costing $27 million. Scheduled for completion in 1959, it will receive western crude through the Interprovincial Pipe Line. Products will be distributed through the company's marketing area in southern Ontario and western Quebec.

In addition to the $27 million project, the company is spending $8 million on expansion of its distribution and marketing facilities in Canada. This program will increase the company's present 750 retail outlets to more than 1,000 in Ontario and Quebec within the next two years.

New Mergers Announced

Under latest announced merger plans, Westcoast Transmission Co. Ltd. will take over assets of Peace River Natural Gas Co. Ltd., Calgary, with approval of the latter's shareholders. Canadian Emjay Petroleums Ltd., Calgary, plans to acquire assets of Mid-Hudson Gas Corp., Hamilton, N. Y., under plans subject to approval of the latter's shareholders.

The Peace River Natural Gas Co. has interests in 2,304,000 gross acres, mainly in Northeastern British Columbia, and shares in a large portion of the natural-gas reserves developed by Pacific Petroleum Ltd., in that district. Its acquisition by Westcoast would give Westcoast its own natural-gas producion, making it an integrated company. Acquisition would be made on a basis of one share of Westcoast for three shares of Peace River Natural Gas.

In taking over assets of Mid-Hudson, Canadian Emjay would change its name to Consolidated Emjay Petroleums Ltd. Shareholders have approved an increase in shares from 3,000,000 to 6,000,000; the change of name and the plans to acquire assets of the Hamilton company in exchange for 4,500,000 shares of Consolidated Emjay. Mid-Hudson has 100 producing gas wells in Pennsylvania and a 50% interest in the Kansas City Gas Corp., which has 19 wells in Kansas.

Pacific Petroleums Ltd. will emerge as an estimated $200 million company—one of the largest Canadian independents—as a result of its proposed acquisition of Merrill Petroleums Ltd. Pacific's proposal to acquire Merrill on a share exchange basis of two Merrill shares for one Pacific would give Pacific a strong income position, enabling it to carry out a most aggressive exploration program. Pacific's assets, upon the acquisition of Merrill, would amount to nearly an estimated $200 million, including combined oil reserves in the neighborhood of 60 million barrels, gas reserves of more than half a trillion cubic feet, and a gross land spread of close to 12 million acres equal to a net wholly-owned 4,370,000 acres.

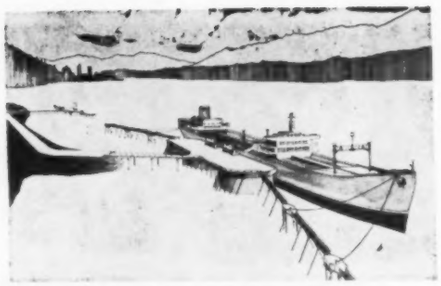
Other major assets, now owned by Pacific, include one million shares (20% interest) in Westcoast Transmission, 1,642,495 shares in Peace River Natural Gas Co., plus substantial share interests in Canadian Atlantic Oil Co., Inland Natural Gas, New Gas Exploration Co. of Alberta, and Alberta Phoenix Tube and Pipe Mills.

Trans Mountain Delivers 160,000 B/D

Trans Mountain Oil Pipe Line Co. reports total deliveries of crude for July averaged 169,082 b/d. The scheduled deliveries for August, were 160,000 b/d.

New Refinery Units for Wainwright

Wainwright Producers & Refiners Ltd., a subsidiary of American Northland Oil Co. (a California firm), has retained Ralph M. Parsons Co., Los Angeles, to design a thermal cracker, platformer, polymerization plant, desulfurizer, and other equipment for its Wainwright, Alberta, refinery. The firm's refinery will increase its gasoline yield by 100% and its distillate and diesel yields by about 80% through installation of the units. The refinery has a present throughput capacity of 4,500 b/d of crude. Parsons will engineer the flow sheet and processing, and prepare construction specifications for the 3,000 b/d thermal cracker and the 1,000 b/d Platformer.



TRANS MOUNTAIN MARINE TERMINAL—VANCOUVER, B.C.: Artist's conception of proposed new dock with 60,000-ton tanker moored at dock.

Trans Mountain Marine Terminal—Vancouver

Trans Mountain Oil Pipe Line Co. will complete in 1958 (April) a large modern oil-loading dock at the company's Westridge marine terminal on Burrard inlet, in order to accommodate the more general use of 60,000-ton class supertankers for lifting Canadian crude oil.

The new dock will be the largest of its type in Vancouver harbor, 250 ft long, supported by three main cells. The entire structure will be noncombustible, with aluminum walkways leading to mooring dolphins at both ends of the main dock, giving an overall length of 950 ft. Special spring-loaded bumpers on the side of the main structure will protect the dock and the tanker against impact forces during docking. The dolphins will be equipped with electric mooring winches for the smooth handling of the large vessels. The oil-loading lines are especially designed for fast handling of large shipments. The conventional loading hoses will be replaced by hydraulically controlled steel Chiksan "swing arm" loading devices. (A new causeway will provide access to a short bridge leading to the dock.)

Atlantic Expands Canadian Search

The Atlantic Refining Co. (not to be confused with the Canadian Atlantic Oil Co. Ltd.) has announced plans to expand its search for crude in Canada to the provinces of Alberta and British Columbia. As a reflection of this new program, Atlantic reported that, jointly with the Tidewater and Samedan oil companies, it has acquired a second tract of 6,560 acres in the Pembina-Keystone area of Alberta. Two indicated producing wells, drilled by other companies, offset this new acreage.

Recently it was that, together with the Mobil Oil Co. Ltd., Atlantic had been the successful purchaser of approximately 92,000 acres in the Virginia Hills area southeast of the Sturgeon Lake Field in Alberta. A successful exploratory well was recently completed by another company about one mile from this new acquisition. To coordinate this expanded exploratory program, Atlantic is establishing a district office in Calgary, which will be manned by geological, geophysical, and land personnel.

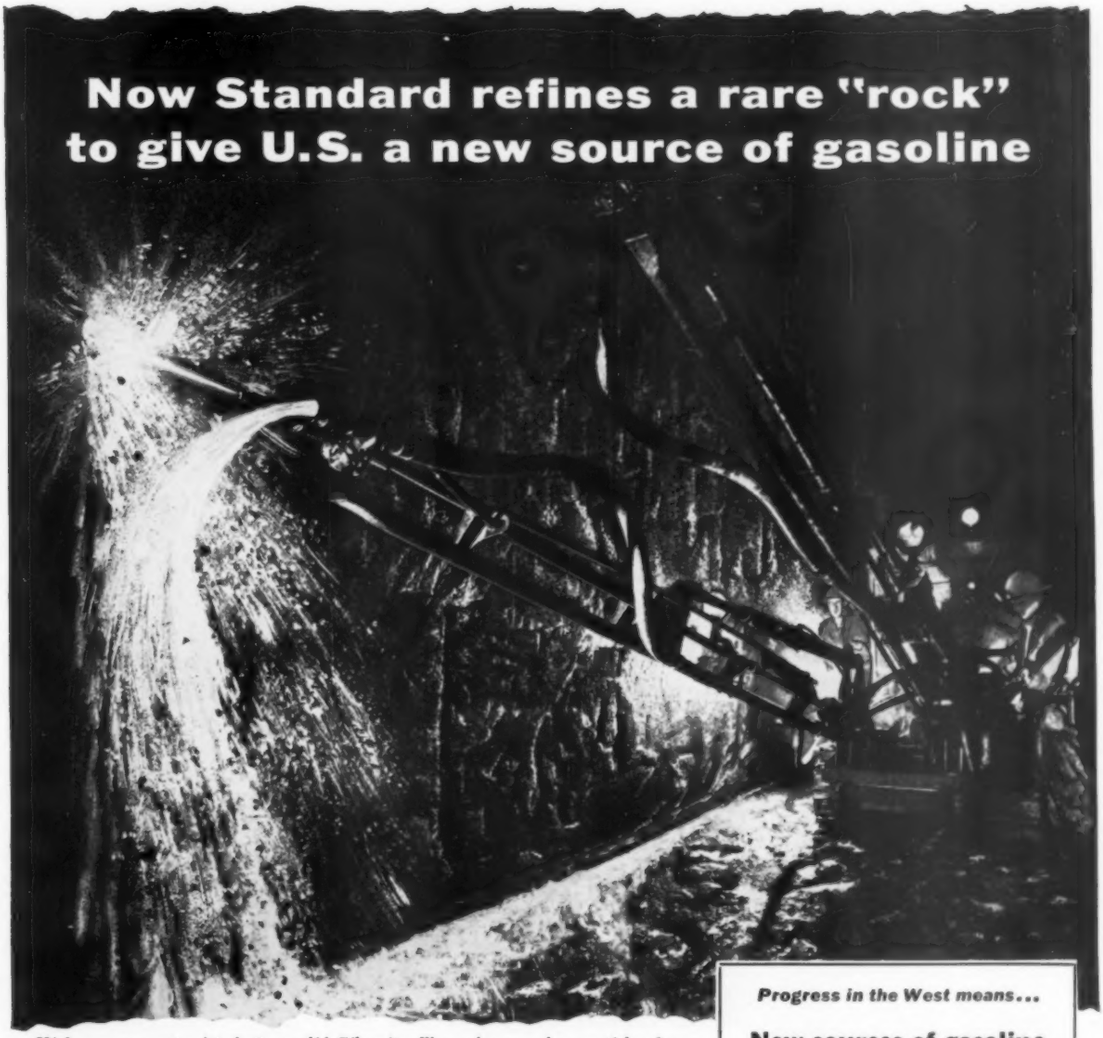
Previous to these new acquisitions, Atlantic's activities in Canada have been limited to Saskatchewan—where, with three other companies, it has a 20% interest in 1,557,000 acres. The group's production from that acreage at the end of 1956 had reached 7,000 b/d.

Royalite Has Yukon Distributor

Royalite Oil Co. Ltd. has announced appointment of C. E. (Bud) Fisher and Associates as agents for distribution of Royalite products in the Yukon Territory, in accordance with an agreement which Royalite has entered with Alaska-Yukon Refiners & Distributors Ltd. The distribution firm will operate as Yukon Shamrock Distributors Ltd.—with offices at Whitehorse. Royalite's representative for this area will be Garfield Grant, formerly in Vancouver. He, too, will be located at Whitehorse.

DANIEL A. FREEMAN, Jr., has been appointed vice president in charge of the New York office of Westcoast Transmission Co. Ltd., Canadian natural-gas pipeline concern.

Now Standard refines a rare "rock" to give U.S. a new source of gasoline



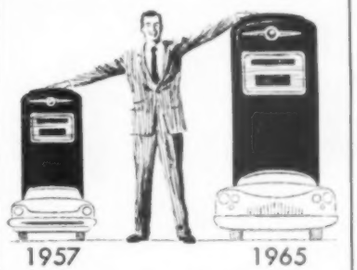
High pressure water jet shatters solid Gilsonite. Flume hose washes particles down mine floor to pipeline.

Petroleum products are now being made without crude oil. Standard found the answer in a rare hydrocarbon called Gilsonite. But it took $16,000,000 and a vast research program to do it. Deep in the mountains of Utah our scientists worked out a better, faster way to mine Gilsonite. Meanwhile our engineers designed the nation's first pipeline capable of carrying solids suspended in water . . . over rugged terrain to a spot 72 miles away.

There Standard* built the nation's first privately financed refinery to make petroleum products from a material other than crude oil. Today that refinery turns Gilsonite into high octane gasoline for motorists, and the purest coke known for making steel, aluminum and other metals. In our country's search for new sources of fuel, the development of Gilsonite is a major breakthrough. It means the equivalent of 100,000,000 barrels of oil added to U.S. underground reserves—important help in meeting our country's growing petroleum needs.

Progress in the West means...

New sources of gasoline to fuel 5½ million more motor vehicles by 1965†

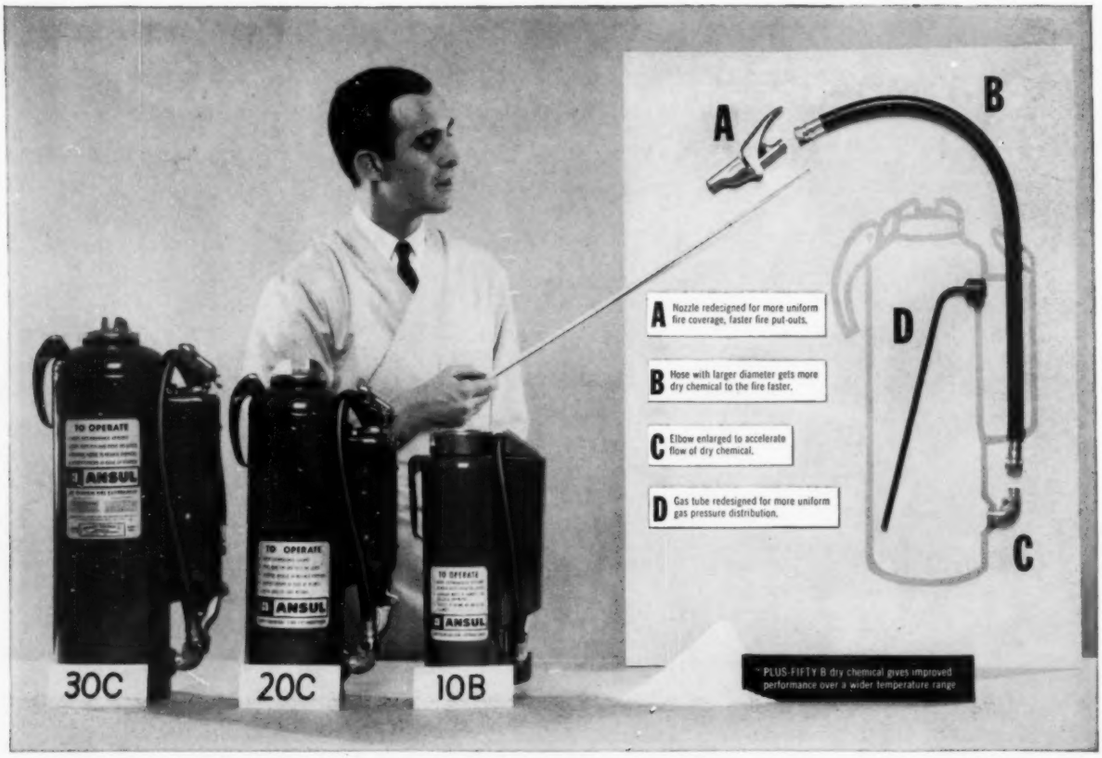


†*In 11 Western States*

STANDARD OIL COMPANY OF CALIFORNIA

plans ahead to serve you better

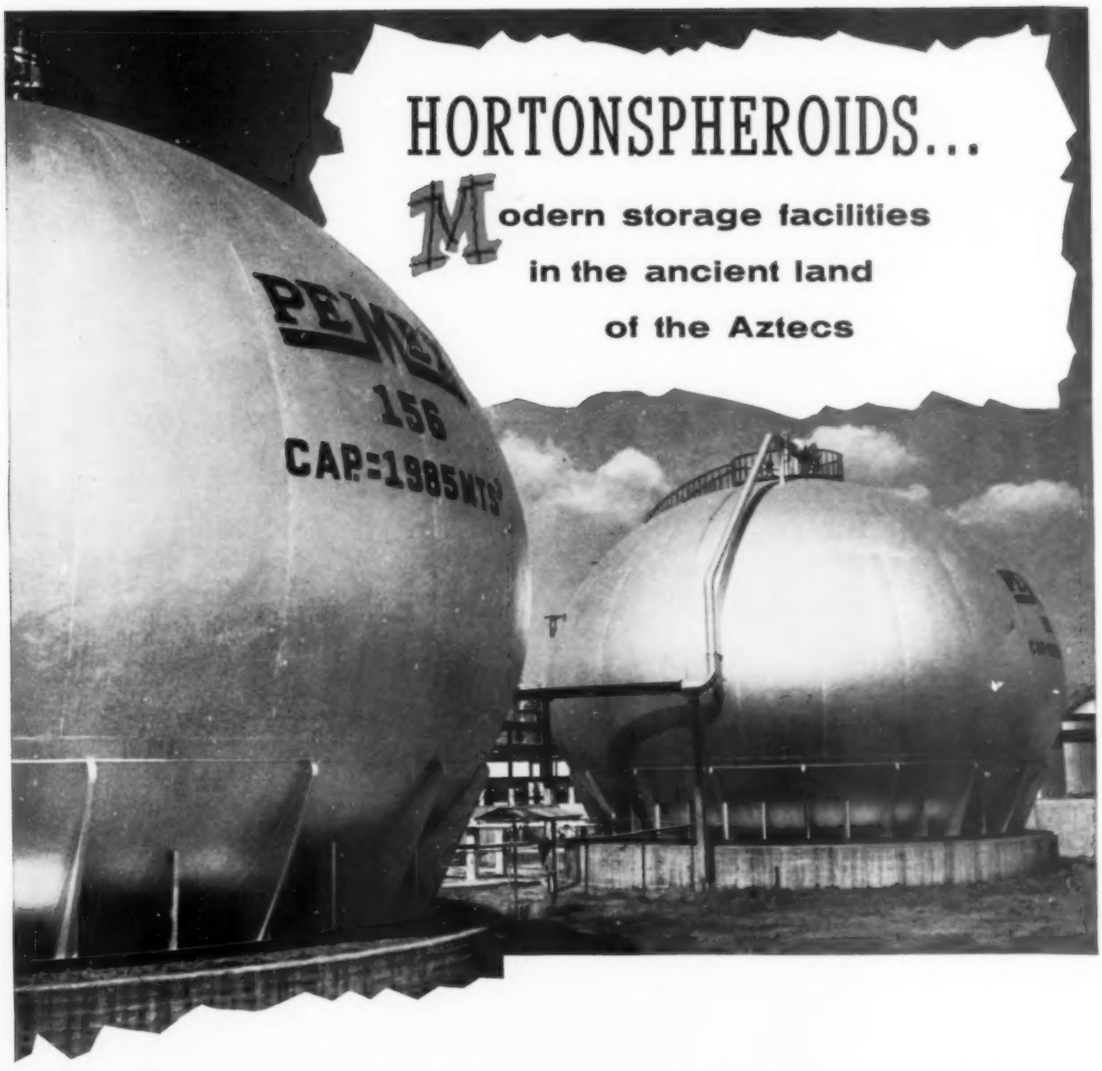
*****Through American Gilsonite Company, a Standard affiliate*


A
B
C
D
A Nozzle redesigned for more uniform fire coverage, faster fire put-outs.
B Hose with larger diameter gets more dry chemical to the fire faster.
C Elbow enlarged to accelerate flow of dry chemical.
D Gas tube redesigned for more uniform gas pressure distribution.
TO OPERATE
ANSUL
30C
20C
10B
* PLUS-FIFTY B dry chemical gives improved performance over a wider temperature range

Important design improvements in these Ansul Extinguishers give you more fire fighting power at no increase in price. Three years of research and more than 2000 fire tests turned up some significant new information on dry chemical extinguishment. Ansul engineers were able to design these findings into three new extinguisher models, the 10B, 20C and 30C. Result, greatly increased fire fighting power. All Ansul equipment is backed by a five-year warranty. This is the best way we know to say Ansul fire extinguishers are the finest of their kind made anywhere.

ANSUL

The Ansul Chemical Co., Marinette, Wisconsin



Bronze faced Aztec chiefs once trod the ground where these modern Hortonspheroids® are built. Located at Petroleos Mexicanos Atzcapotzalco Refinery on the outskirts of Mexico City, a city whose foundations were laid on the ruins of an old Aztec temple, these Hortonspheroids provide dependable pressure storage for the refinery's volatile hydrocarbons. No vapor can escape from a Hortonspheroid as long as the internal pressure does not exceed the pressure relief valve setting.

Modern steel plate structures for the pressure storage of volatile liquids are the result of CB&I's *complete* facilities for designing, fabricating and erecting welded steel plate structures to the exacting specifications of the petroleum industry . . . *anywhere in the world!* Further information, estimates or quotations on Horton® structures may be obtained by writing our nearest office.

Chicago Bridge & Iron Company

Plants in: BIRMINGHAM, ALA. • CHICAGO, ILL. • GREENVILLE, PA. • SALT LAKE CITY, UTAH

REPRESENTATIVES, LICENSEES and SUBSIDIARIES: Australia—Bernard-Smith (Pty.) Limited, Alexandria (Sydney); Evans Deakin & Co. Ltd., Brisbane • Canada—Horton Steel Works Limited, Toronto • Cuba—W. P. Bryant, Edifico Abreu 402, Havana • Brazil—Sociedade Chibridge de Construcoes Ltda., Rio de Janeiro • England—Chicago Bridge Limited, London; Whessoe Limited, Darlington • France—Constructions Metalliques de Provence, Arles-sur-Rhone; S. A. Ateliers et Chantiers de la Seine Maritime, Le Trait • Germany—Wilke-Werke AG, Braunschweig; Gutehoffnungshutte, Oberhausen-Sterkrade • Italy—Compagnia Tecnica Industrie Petroli, Rome • Japan—Ishikawajima Heavy Industries Co., Ltd., Tokyo • Netherlands—Comprimo N. V., Amsterdam • Scotland—The Motherwell Bridge & Engineering Co., Ltd., Motherwell • Venezuela—Chicago Bridge & Iron Company Ltd., Caracas

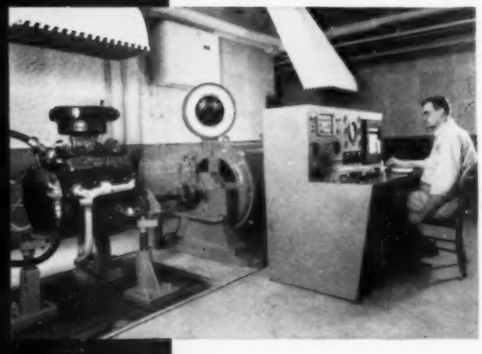
OFFICES: Atlanta • Birmingham • Boston • Chicago • Cleveland • Detroit • Houston • New Orleans • New York
Philadelphia • Pittsburgh • Salt Lake City • San Francisco • Seattle • South Pasadena • Tulsa

What took the spark

This unretouched photograph, taken by Edmund F. Hawes, UOP Staff Photographer, was awarded First Prize in the 1956 ASTM Photographic Exhibit.

out of this plug?

The old problem of the fouled-up spark plug is less acute today because of modern improvements in petroleum refining. Most refiners are taking the utmost precautions to make sure that the motor fuels they produce burn clean, quick and with the full power needed for today's high compression, high-speed engines. Throughout the refining industry research technicians are constantly checking the fuels their refineries produce to help guard against plug fouling and to maintain all the high performance characteristics demanded by today's automotive engines. In this way they are helping to make and keep the products you market salable. Here at UOP, in our business of developing processes for the manufacture of motor fuels, we also never take our eyes off the performance of the end product. Our research and technical staffs are constantly concerned with the fuels made by UOP processes to make sure that these will have the performance qualities that will give their ultimate users full satisfaction. This is only part of the broad contribution research is making toward the salability of products from petroleum. Wherever you market, you can be sure that "men of science" are constantly working to keep the products you sell at the quality level your customers demand.



This is a modern V-8 engine and dynamometer used in the UOP Engine Laboratory to analyze all phases of motor fuel performance including engine cleanliness test. It is one of the tools used by UOP technicians to develop methods for producing fuels having all of the characteristics necessary to satisfy the petroleum marketers' most demanding customers.

More Than Forty Years Of Leadership
In Petroleum Refining Technology

UNIVERSAL OIL PRODUCTS COMPANY

30 Algonquin Road, Des Plaines, Illinois, U. S. A.

L. C. Kemp, Jr.

J. H. Rambin, Jr.

J. T. Wood, Jr.

T. A. Mangelsdorf

E. R. Filley

C. B. Barrett

Texaco's New Vice Presidents

Augustus C. Long, chairman of the board of The Texas Co., has announced election of four senior vice presidents and three vice presidents. Claude B. Barrett, formerly vice president at Houston, becomes senior vice president and chief executive officer, at Houston. Everett R. Filley, formerly vice president in charge of the producing department-domestic, becomes senior vice president in charge of Texaco's worldwide producing interests and activities.

Theodore A. Mangelsdorf, formerly vice president, becomes senior vice president in charge of the company's worldwide refining interests and activities. James T. Wood, Jr., formerly vice president at Los Angeles, becomes senior vice president and chief executive officer at Los Angeles.

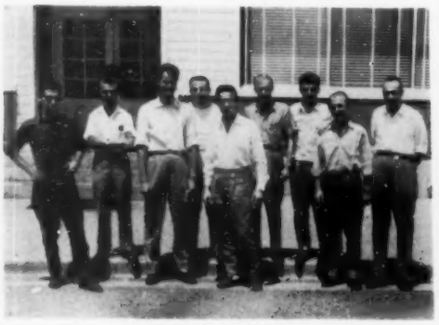
The new vice presidents are: J. B. Christian, formerly chairman and managing director of Trinidad Oil Co. Ltd., a Texaco subsidiary, who becomes vice president in charge of Trinidad operations, with headquarters in New York. L. C. Kemp, Jr., formerly general manager of Texaco's petrochemical department, who becomes vice president in charge of that department. Mr. Kemp will be responsible for the company's interests in the field of petrochemicals. J. Howard Rambin, Jr., formerly assistant to the vice president in charge of the producing department-domestic, who succeeds Mr. Filley as vice president in charge of that department.

Electric Rigs for 25,000-Ft Drilling

Development of the first of a series of drilling rigs intended primarily for electric application has been announced by The National Supply Co. The new rig is in the class of National's biggest mechanically powered rig, the/Type 160, introduced in 1948, which in 1949 was the first to drill below 20,000 ft. Identified as the/Type 1625DE, it will normally be considered for drilling in the 16,000-ft to 25,000-ft depth range, using $1\frac{3}{8}$-in. or $1\frac{1}{2}$-in. wire line, and utilizing from 1,300 hp to 2,000 hp delivered through electric motor drives. The/Type 1625DE drawworks is basically of one-piece design, on a heavy 18-in. beam base, and embodies provision for a sand reel. A rear section which accommodates the electric motors and the motor-drive portion of the drawworks transmission may be detached for transportation purposes. The rotary may be driven by a countershaft, accommodated on a small, detachable front section of the drawworks base, or by an independent electric motor.

Czechs Construct Electric Drill

Successful testing on the South Moravian oil fields of an electric drill of Czechoslovak make was officially reported from Prague. In comparison with diesel-driven drilling equipment, the electric drills were said to be noiseless, faster, easier, and more exact in operation, and expenditure for driving power about two-thirds cheaper.



Temporarily stationed at Phillips Chemical Co.'s Plains synthetic-rubber plant near Borger, Texas, are these nine representatives of ANIC, the Italian company which is building a synthetic-rubber plant at Ravenna, Italy, using the synthetic-rubber process licensed by Phillips. They are (left to right): Ettore Gismondo, Dr. Gianantonio Stampanoni, Dr. Pietro Pauletti, Umberto Dotti, Lucantonio Conforti, Marcello Benini, Werther Vigenti, (Bill) Guglielmo-Borsi, and Franco Stella. At the Phillips facility the men will receive training in operations, maintenance, and engineering in preparation for startup of the Italian company's plant late this year. Dr. Pauletti is expected to be operating superintendent of the new plant, designed to produce 33,500 tons of synthetic rubber per year.

Portable Camp Units

Morrison Railway Supply Corp., Buffalo, N. Y., has designed a series of portable units for housing personnel in remote locations such as those often encountered in international oil operations. Among the seven standard models are 8-man dormitories with built-in showers and sanitary facilities, 8-man combination kitchen, dining and recreation trailer. These are supplemented with trailers with self-contained units with complete facilities for two and special-purpose trailers with dining and recreation facilities for as many as 22 with separate kitchen.

All-Butyl Truck Tires

The USA Department of the Army has approved all-butyl truck tires for heavy duty service in 9.00 x 20 size. Pennsylvania Tire Co., with the assistance of Esso Research and Engineering Co., whipped the problems involved. These included modifying agents to prevent overheating and a butyl latex dip for effective bonding. Study now is in progress on larger tire sizes. An advantage of the new butyl tires is the resistance to deterioration in storage.

Jess E. Hall, Jr., president of Weatherford Tool Co. (left) is shown returning from a month's tour of European countries. With Weldon Martin, manager of finance for the company, also shown above, and Tom Remp, export manager, he investigated Europe's possibilities for oil-tools markets, especially under the new "Common Market."

"The future looks good for the oil industry in Europe," Mr. Hall said. "There are going to be some lean years for oil-tool manufacturers, but I feel that one must get his foot in the door now if he intends to have a good solid spot in the industry—an industry that should mature in about 10 years. By that time, trade restrictions will have decreased, and the number of wells drilled will have increased to the point where oil-tool manufacturing and service companies can operate profitably."

Nationalist China Begins Tanker Construction

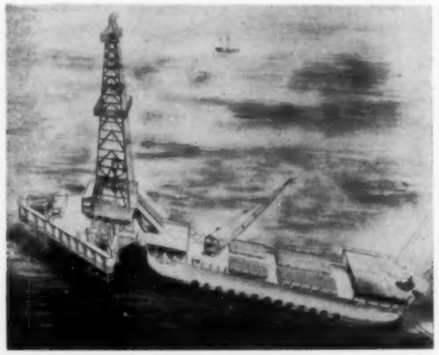
Nationalist China is beginning large-scale shipbuilding with the construction of the first supertankers on Taiwan. "Production will be competitive in cost with the lowest in the world, and in quality will equal USA standards," according to Dr. Magnus I. Gregersen, chairman of the board of Ingalls-Taiwan Shipbuilding & Dry Dock Corp., Taipei. A $5-million contract with Westinghouse Electric International Co. has been signed for six 18,600-hp marine propulsion units. Engines will power 36,000-dwt supertankers.

The first two of these supertankers being built by Ingalls-Taiwan have been chartered to the Gulf Oil Co.

Plans call for the construction of 36,000-ton tankers, but a berth for ships up to 65,000 tons is being built at Keelung. On its completion early in 1959, the planned annual capacity of 200,000 tons will have been attained—Dr. Gregersen said. He explained that this total includes one 65,000-ton and four 36,000-ton ships.

Poland Reports New Oil Field

Discovery of a new oil field near Ustrzyki Dolne, Rzeszow Voivodship, was reported by the official Polish press agency. Two wells already have been brought down at Logyna.



World's first "miniature" mobile platform designed specifically for use with a platform tender has been announced by R. G. LeTourneau Inc. for Arabian American Oil Co., of New York. When completed, it will be towed across the Atlantic to work in the Persian Gulf off Saudi Arabia.

The agile job-hopper sold for less than $750,000—relatively small change in an injustry where even permanent-type platforms often cost over $1 million. Due to simplified construction, the unit is scheduled for five-month delivery. The diminutive size and bargain-basement price are due to the fact this unit will be used only with a platform tender.

Dimensions of the miniature platform are: length, 92 ft overall; 88 ft wide; depth of hull, 10 ft; length of spuds, 103 ft; diameter of spud tanks, 18 ft 4 in; height of spud tanks, 10 ft; total load during elevation, 112½ tons; maximum load in fixed position, 350 tons.

DOCTOR OF SHIPS

Rick Bruhn specializes in preventive "medicine."

Rick is the Mobil marine engineer in Hong Kong. His counterparts work in every major Free World port—more than 400.

As you trust the skill, training and experience of your doctor, so do the men who know marine machinery trust the Rick Bruhns to diagnose their ships' needs and prescribe the right fuels and lubricants.

Mobil know-how created the first and most comprehensive service of this kind. It helps make sure that goods you send or receive move without delay—that as a passenger you arrive and depart on schedule—that every voyage is a Bon Voyage.

This is the master's touch in oil—servicing the world's mightiest warship, the world's fastest boat, every flagship of every leading ship line, two-fifths of all the world's freighters as well as the first atomic-powered submarine.

SOCONY MOBIL OIL COMPANY, INC.

and Affiliates: Magnolia Petroleum Co., General Petroleum Corp.

Leader in lubrication for 91 years

Mobil

London Letter

By E. Lawson Lomax

Tanker Rates Low

Single-voyage freight rates for tankers are at their lowest for two years. At present there seems to be little prospect of increase, as the volume of business available is not sufficient. Therefore, it would appear competition for cargoes in the near future will become fiercer and the rates will fall further. Time charter rates also have fallen, but not to the same extent as single voyage rates.

The July average assessment of the London Tanker Broker's Panel was scale plus 31.9%, whereas on January 1 it was scale plus 74.8%. In the USA a low figure of USMC less 60% has been accepted for a 12,000 dwt vessel from the Persian Gulf to California, and the same figure for a 33,000-tonner from Sidon to USNH. Another 33,000-tonner has been booked for 12 consecutive voyages at USMC minus 20%.

These falls in freight rates seem to have risen mainly from two causes, viz., an increase in the number and size of tankers completed in the first half of the year, and an excessive drop in the normal seasonal oil consumption.

According to Davies and Newman, well-known tanker brokers, 86 tankers were completed during the first half of the year, and of these more than half were over 30,000 dwt each. The Maritime Transport Commission of OEEC says the world tanker fleet is increasing at a greater rate than is world oil production, and these increases will be greater in the next few years. However, a straight comparison on these lines is not logical, as it ignores that the USA is responsible for about 47.4% of Free World crude production, and the percentage of this oil transported by tanker at any stage—either crude or refined—is very small compared with production in the rest of the Free World. On the other hand, the production of the Middle East fields—equal to 20% of the Free World's production—has practically all to be transported by tanker and, in addition, it entails long hauls. It should be noted also that Middle East production the first half of the 1957 was about 12 million tons less than in the equivalent half of 1956—although it is now increasing, and was 1.1 million tons greater in June than in May.

An interesting development in the present tanker situation is one in connection with British Tankers Ltd. (British Petroleum subsidiary). The parent company has made arrangements to lay up temporarily nine of its 12,000 dwt vessels—with full cargoes and in full operating condition. If one of the company's installations requires supplies quickly, any one or all of the laid-up vessels can be dispatched almost immediately. It is hoped to bring these vessels back into full service in the winter.

Esso Orders New Rail Tank Cars

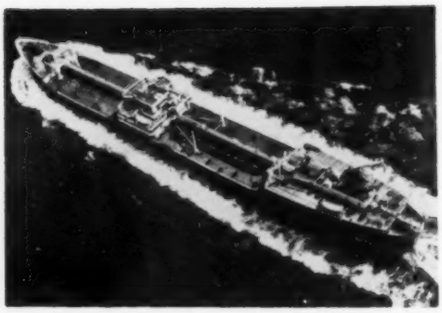
Esso Petroleum Co. Ltd. has placed orders for 743 rail tank cars of a new specification with Hurst Nelson & Co. Ltd. (314 cars); Charles Roberts Ltd. (315 cars); and Cambrian Wagon Co. Ltd. (124 cars).

These include both class "A" and "B" types—the "B" type being fitted with steam-heating coils. These cars are being built to a new specification, as they are to be used on freight trains traveling at speeds up to 70 mph. The gross load is 35 tons, and they will be fitted with roller-bearing axle boxes, hydraulic buffers, and vacuum brakes. Cost of cars is £1.25 million.

Oxygen Flame-Cleaning Process

British Oxygen Co. has developed a process for preparation of steel structures, vessels, tanks, etc., for painting, by preliminary cleaning with an oxy-acetylene flame, and has devised burners for carrying out the process.

The common methods of preparation by chipping and wire brushing, or by sandblasting, are superseded, and the metal is left warm and in good condition for receiving the paint.



Aerial view of BP Tanker Co.'s 32,000 dwt oil tanker "British Valour," seen during her speed trials in the North Sea.

Tanker News

Overseas Tankship (UK) Ltd., a Caltex organization, has announced that the 17-knot 32,000 dwt S.T. tanker "Caltex Arnhem," built by Mitsubishi Heavy Industries Reorganized Ltd., Kobe, Japan, was launched, July 26. The vessel is due for delivery in October to NV Nederlandsche Pacific Tankvaart Mij. (one of the Caltex group of companies), and will trade mainly between the Middle East and Holland.

Vickers-Armstrong Ltd. has announced the 16.5-knot S.T. tanker "San Gregoria," building by them to the order of Eagle Tanker Co. Ltd., was launched from Barrow Shipyard, July 26. Vickers-Armstrong is preparing to build tankers up to at least 65,000 dwt.

The 32,000 dwt S.T. tanker "British Justice," building to the order of BP Tanker Co. Ltd., was successfully launched from Birkenhead Shipbuilding yard, July 26.

The 32,000 dwt S.T.S. "Vetrina," built for Shell Tankers Ltd., successfully completed her sea trials, July 3, 1957.

S.T.S. "Virginia," built for Neuva Vista Compañia Navera SA, of Panama, successfully passed her seagoing trials, July 17, and subsequently was handed over to her owners. Her design speed of 15.5 knots was easily exceeded.

BP and Shell Quit Israel

On July 22nd, Shell Petroleum Co. Ltd. and The British Petroleum Co. Ltd. announced they are closing down their operations in Israel. According to officials of these two companies this decision applies to their joint marketing interests, which during the past few years have not proved commercially attractive.

Their other joint-interest in Israel is the Consolidated Refineries Ltd., with its refinery at Haifa. This refinery has a capacity of 4 million tons per year (80,000 b/d) but since 1948 has only been working at about 20% capacity, mainly on imported crude oils as the flow of oil for the Iraq Petroleum Company's fields through the 12-inch and 16-inch lines to Haifa was stopped in that year.

At the present time a 6-inch line is being laid between Haifa and Tel Aviv was due for completion in August. This pipe line will have a capacity of 500,000 tons per year (10,000 b/d).

No decision has yet been made regarding the Haifa refinery, but under the present circumstances it would not appear to be commercially profitable to the owner company to continue its operation, especially since production of crude oil in Israel is not yet sufficiently large to keep it running even at its present rates.

It is understood that Israel has requested the British government to use its influence with the company to keep the refinery in operation, but the British government has replied that any decision taken by the company would be purely on commercial grounds and that interference in commercial operations was not its practice.

New Hydraulic Lifting Gear

Douglas Tugmaster Type DC 3S has been designed to operate overseas, for the specific demands of a leading oil company operating in Venezuela. The tractor is designed to operate for yard shunting and to deal with up to 60-ton trailers at speeds of 1.2 mph to 15 mph.

G. N. Peters

Company News

Gulf Oil Corp. has announced completion of arrangements for formation of a coordinating group, in London, to cover its activities and interests in the Eastern Hemisphere. The following appointments have been made: F. T. Davies, Gulf European Co., coordinator; A. Gregerson, vice president (production), Gulf Eastern Co.; L. D. Gombos, counsel for Eastern Hemisphere; S. V. Gasperini, assistant controller, Gulf European Co.; R. B. Hoffman, marketing manager, Gulf Eastern Co.; R. F. Temp, crude-sales manager, Gulf Eastern; R. G. Martin, transportation manager, Gulf Eastern; P. H. Boersig, assistant treasurer, Gulf Eastern.

H. E. Snow and the Honorable M. R. Bridgeman, managing directors, have been appointed deputy chairmen of British Petroleum Co. Ltd.

Shell Petroleum Co. has announced the following appointments: J. B. Scott, manager, finance administration; C. S. Hadfield, controller; F. S. MacFadzean, treasurer; B. E. Blakeley, deputy treasurer; J. G. van Den Bosch, finance manager and a director of Shell Tankers Ltd.

G. N. Peters has been appointed divisional manager, Shell-Mex and BP Ltd. Northern Ireland Division, in Belfast, succeeding R. G. Collett—who has joined Power Petroleum Co. Ltd. Mr. Peters, who was educated at Rossall and Exeter College, Oxford, joined the company in 1950, and has been attached to various sections of the sales department.

F. M. Ziegler, Kern Oil Co. Ltd. general manager in California, has been appointed a director of Kern Oil Co. Ltd.

Drilling for Gas in Yorkshire

British Petroleum Exploration Co., in conjunction with Imperial Chemical Industries Ltd., has restarted drilling for natural gas in North Yorkshire. Two previous wells had found some gas, and the present test well is being drilled to determine whether gas is present in commercial quantity. This is an entirely different search from that being carried out by BP in behalf of the Gas Council.

New BP Home

A new building, to be known as BP House, is now under construction within 250 yards of Britannic House, which has been the company's headquarters for some years. It is required for the company's expanding activities. The building is "H"-shaped—comprising two wings, each six stories, with a center block of 11 stories connecting these wings. It will be steel-framed and faced generally with portland stone.

Berkeley Nuclear Power Station

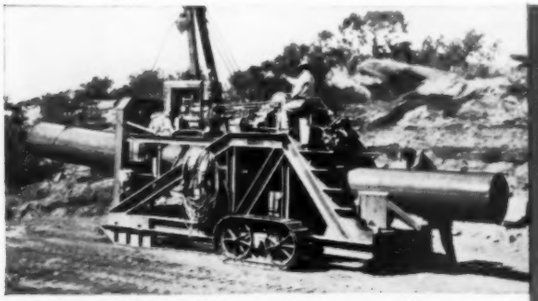
The Central Electricity Authority has nominated Wakefield-Dick Industrial Oils Ltd. as supplier of lubricants to the Berkeley Nuclear Power Station—scheduled to start up in 1960.

Precision control and inch-close accuracy every time with International Superior Sideboom Tractors!

Look at this team of International TD-24 crawler tractors with Superior sidebooms lay a curving 34-in. gas line over a rugged, mountainous course!

A tough job like this demands the precision control of exclusive International TD-24 Planet Power steering. You get full-time power—smooth and steady—for sharp or gradual turns, without a jerk on the heaviest-laden boom! Finger-tip lever clusters, hydraulic brakes and foot decelerator mean inch-close accuracy every time.

Compare bonus-powered International crawlers (4 models) and Superior sidebooms to match, with any units in their class. For gas, oil or water pipe-laying, International-Superior teams can't be beat! See your IH Construction Equipment dealer. He'll give you all the facts and figures.



A husky International U-264 engine powers this pipe bending machine—handling 34-inch, 40-foot lengths of pipe weighing 7,000 lbs. each.

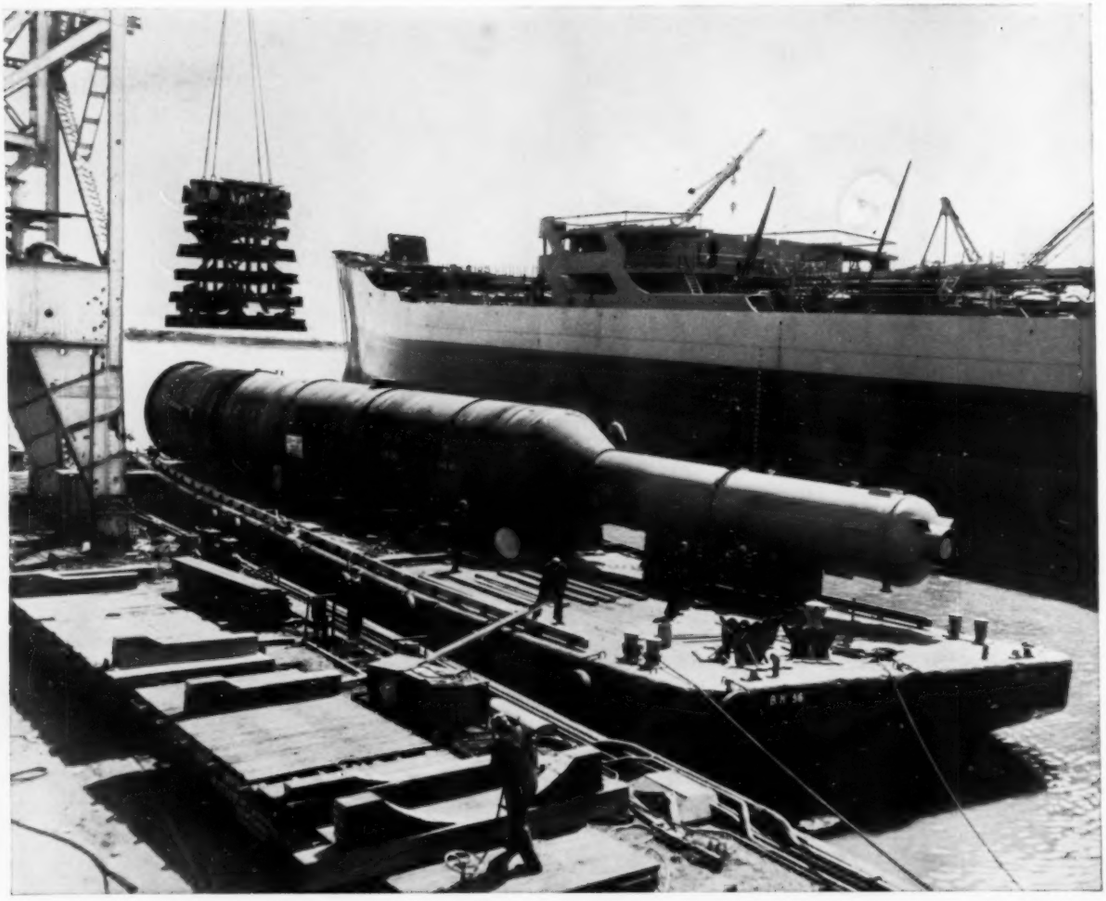
INTERNATIONAL

CONSTRUCTION EQUIPMENT

INTERNATIONAL HARVESTER EXPORT COMPANY
180 N. Michigan Ave., Chicago 1, Ill., U.S.A.

International builds Crawler, Wheel, and Side-Boom Tractors . . . Self-Propelled Scrapers and Bottom-Dumps . . . Crawler and Rubber-Tired Loaders . . . Power Units . . . Off-Highway Trucks . . . Motor Trucks.

INTERNATIONAL HARVESTER



standard procedure: VERSATILITY . . .

The variety of work which Sun Ship's integrated shops produce for use by industries on land and sea brings a matching variety of shipping problems.

Our facilities for tidewater shipment are used to economical advantage on many of the massive structures that go into the making of the nation's petroleum and chemical industries. The barge shipment of tower and shed row baffles, shown above, is a good example.

And of course—when shipment by land is necessary—Sun Ship rigging and routing find the ways and means to handle such items as large-diameter columns by rail and truck.

It's all a part of the versatility which forty years' experience has made part of "standard procedure" in service of its customers.

Our Sales Engineering Department would be glad to use its experience in helping you overcome any problem of construction or shipment that faces you. Write

Sun

SHIPBUILDING & DRY DOCK COMPANY

ON THE DELAWARE (SINCE 1916) CHESTER, PA.

DU PONT *Petroleum Chemicals* NEWS

Number 80 in a Series of Bulletins for the Petroleum Industry

OCTOBER 1957

Du Pont FOA-2 provides advantages to refiners as well as to their customers

"BRIEF CASE" PRESENTATION WELL RECEIVED BY PETROLEUM INDUSTRY AND ITS CUSTOMERS

The "Brief Case for Business" presentation was announced in a NEWS ad last January. Since then 500 kits have been put to use, and they are expected to play an important role in this year's Oil Progress Week. Developed by the DuPont Petroleum Chemicals Division, the "Brief Case" tells an oil industry public relations story in much the same way as the popular "Magic Barrel" has been doing so successfully for nearly five years.

The "Brief Case" presentation, introduced last January 1st, is sponsored by the Oil Information Committee of the API. It tells in a highly dramatic way the importance to the American economy of oil products and of products made from oil. According to OIC estimates, over 1,000 presentations will have been made by November 1 – to club, school and civic groups throughout the country.

Small and low cost

Exhibits in the kit were carefully selected to tell a forceful story. The kit fits compactly into a lightweight, easy-to-carry brief case and costs only $50 complete. If you are not already using the brief case kit, or would like additional kits, any of our DuPont Petroleum Chemicals Division representatives will be glad to help you obtain them.

The versatility of DuPont Fuel Oil Additive No. 2 (FOA-2) provides refiners with processing flexibility as well as sales features for their customers. Here's how . . .

POWER PLANTS can help insure continuous flow of electricity by protecting their fuel oil against sludge formation through the use of DuPont Fuel Oil Additive No. 2.

FOA-2 makes it possible to blend catalytic-cracked stocks with straight-run products and still maintain good storage stability and performance. Because of this, refiners can adjust their inventories of heating and diesel fuels to meet varying seasonal demands. And the storage stability of a catalytic-cracked stock by itself can be increased by the addition of FOA-2.

The additive also helps to upgrade stocks to increase the yield of domestic heating oils, and release straight-run stocks for charging stock.

Protects wide range of products

The stabilizing and dispersant action of DuPont FOA-2 is highly effective across the whole range of distillate fuel oils. This means that the same additive that retards and disperses sludge formations in home heating oils can be used to help prevent injector-sticking and filter-clogging in all types of diesel fuel – for truck, tractor, marine, industrial, and railway locomotive engines.

With this extremely broad range of usefulness, many refiners are able to realize substantial savings in their overall manufacturing and distribution operations through the use of this single additive.

Benefits residuals, too

Because of the nature of the product, sludge problems with residual fuels can be particularly troublesome. Many of the problems can be readily solved by periodic treatment of the system with FOA-2. But it's even easier to prevent them and eliminate many costly tank-cleaning operations by simply adding a small amount of FOA-2 to the residual fuel before it goes into the storage tank.

ADVERTISEMENT—Prepared for the Petroleum Chemicals Division of E. I. du Pont de Nemours & Company (Inc.)

OVER

DUPONT *Petroleum Chemicals* NEWS

CONTINUED *FOA-2 Advantages*

Many residual fuel users, both large and small, have already found that FOA-2 will keep their fuel storage and supply systems clean and their burners operating smoothly. Thus, substantial savings are made by eliminating costly downtime for cleaning.

For detailed information

To help you benefit fully from FOA-2 in all these applications, we will be glad to send you a comprehensive 24-page book about it.

All the basic information you will need is included in this book—composition and properties, use concentrations, handling and addition methods, performance testing, and a discussion of the benefits of FOA-2 in all its applications.

Many refiners find pre-mixed additives more convenient

A new combination "package" of DuPont Fuel Oil Additive No. 2 premixed with DuPont Metal Deactivator has been offered to refiners during recent months.

We've heard many favorable comments on this new combination from refiners who have tried it. It has proved a convenience to be able to add a single additive with combined properties that guard against practically all the major chemical causes of heating oil and diesel fuel troubles, specifically sludge and gel accumulations.

The new combination is available to you in drums in two different concentrations . . . FOA-208 – 92% FOA-2, 8% DMD; and FOA-212 – 88% FOA-2 and 12% DMD.

You ought to know . . .

JOHN D. ROGERS is supervisor of the jet and aviation fuels research group at the DuPont Petroleum Laboratory, Carney's Point, New Jersey. In this capacity he serves as an aircraft engineering consultant, working closely with the engine manufacturers and Navy and Air Force test centers on evaluation of fuel performance in the latest aircraft. And his staff at the laboratory analyzes trends in military requirements and related commercial developments to help refiners meet present and future demands for aviation petroleum products.

His broad experience has ideally equipped him to provide refiners with competent aid in these fields.

He joined the DuPont Company in 1951 as a senior engineer at the Petroleum Laboratory. He did engine and combustion research on fuels, and worked with refiners on automotive performance studies until 1954. Before coming to DuPont, he did development work on rocket and jet aviation fuels for a major oil company. During World War II, he was with an aeronautical corporation as combustion analyst and design engineer on B-29 engines.

Mr. Rogers received his B.S. degree in mechanical engineering at the University of Delaware. Later he was an instructor at Yale University, specializing in internal combustion engines. He has also a master's degree from Stevens Institute of Technology, and did advanced study of thermodynamics and fluid mechanics at the University of California in Berkeley.

He is a member of the Institute of Aeronautical Sciences, American Rocket Society and the Society of Automotive Engineers. He is active on the Aviation Fuels Technical Committee of the ASTM and the Aviation Fuels Division of the Coordinating Research Council.

LITERATURE AVAILABLE

Here is a partial listing of the many bulletins, reports, booklets, technical papers, and other aids available to you through any of the DuPont Petroleum Chemicals Division offices:

DuPont FOA-2—A comprehensive 24-page book containing all the basic information you will need to have about DuPont Fuel Oil Additive No. 2 for its application in heating, diesel and residual fuels. Fully illustrated with photographs, charts and diagrams A-4966

New DuPont Dry-dye Eduction Probe and No-dust Drumhead—A folder describing and illustrating the revolutionary new dry-dye eduction devices, which make gasoline dyeing a cleaner, faster, and more efficient operation A-2903

DuPont Petroleum Dyes – Includes data on chemical composition and physical properties of the complete line of DuPont Petroleum Dyes. Also spectrophotometer curves, rate of solution tables, military specifications, addition methods and handling recommendations A-2723

Sales Promotional Aids for Dealer Meetings—Describes the many DuPont aids available for dealer meetings. A handy check list for anyone planning dealer meeting programs A-98

You can order by number from the nearest office listed below.

SALES OFFICES

Chicago 3—8 So. Michigan Ave. . . . RAndolph 6-8630
Cleveland 15—25 Prospect Ave. . . . SUperior 1-1363
Denver 2—Petroleum Club Building, 16th & Broadway . . . . . AComa 2-2347
Houston 2—705 Bank of Commerce Bldg. . . . . CApitol 5-1151
Los Angeles 17—612 So. Flower St. . MAdison 5-1691
New York 20—1270 Ave. of the Americas . . . . . COlumbus 5-2342
Philadelphia 2—3 Penn Center Plaza . LOcust 8-3531
Pittsburgh 22—1 Gateway Center . . ATlantic 1-2933
San Francisco 4—111 Sutter St. . . . EXbrook 2-6230
Seattle 3—4003 Aurora Ave. . . . . MElrose 6977
Tulsa 1—1811 So. Baltimore Ave. . . . . LUther 5-5578
In Canada—DuPont Company of Canada (1956) Limited, Petroleum Chemicals, 85 Eglinton Ave. East, **Toronto 12**—Ontario . . . . . HUdson 1-6461
In Other Countries—Organic Chemicals Department, Export Division, 7447 Nemours Bldg., Wilmington 98, Del., OLympia 4-5121, Ext. 2962.

DU PONT
REG. U. S. PAT. OFF.

Better Things for Better Living
. . . through Chemistry

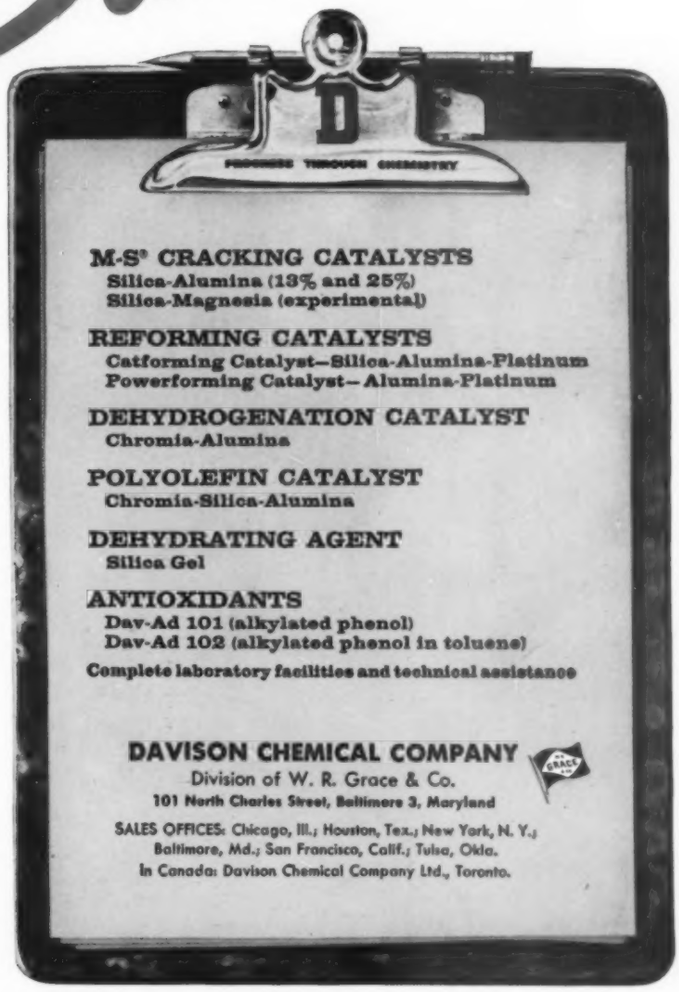
OVER

ADVERTISEMENT—Prepared for the Petroleum Chemicals Division of E. I. du Pont de Nemours & Company (Inc.)

A-5245

Printed in U. S. A.

Refinery men depend on Davison for...



M-S® CRACKING CATALYSTS
Silica-Alumina (13% and 25%)
Silica-Magnesia (experimental)

REFORMING CATALYSTS
Catforming Catalyst—Silica-Alumina-Platinum
Powerforming Catalyst—Alumina-Platinum

DEHYDROGENATION CATALYST
Chromia-Alumina

POLYOLEFIN CATALYST
Chromia-Silica-Alumina

DEHYDRATING AGENT
Silica Gel

ANTIOXIDANTS
Dav-Ad 101 (alkylated phenol)
Dav-Ad 102 (alkylated phenol in toluene)

Complete laboratory facilities and technical assistance

DAVISON CHEMICAL COMPANY
Division of W. R. Grace & Co.
101 North Charles Street, Baltimore 3, Maryland

SALES OFFICES: Chicago, Ill.; Houston, Tex.; New York, N. Y.; Baltimore, Md.; San Francisco, Calif.; Tulsa, Okla.
In Canada: Davison Chemical Company Ltd., Toronto.

International Panorama of Progress

A wider world for fabrics

CALTEX

PETROLEUM PRODUCTS

In many countries, the subtle influences of past traditions and customs have been combined with modern materials and modern design to create completely new trends in fashion ☆ This resurgence-in-textiles on the part of European and other nations has broadened their panorama of progress and created a wider world for fabrics through expanded production, employment and opportunity ☆ The textile industry is just one of many nourished by Caltex quality fuels, oils and lubricants ☆ Through the power of petroleum, Caltex keeps industry and every segment of society expanding, contributing to the prosperity of today and holding forth the promise of an even brighter tomorrow to over 70 countries—partner in progress in Europe, Africa, Asia, Australia and New Zealand.

International Paints for the OIL INDUSTRY

BASRAH PETROLEUM COMPANY LIMITED: Fuel storage tanks at Zubair Power House.

When you specify the paint for an oil installation, the stakes are high. On the one side, plant and equipment of enormous capital value; on the other—corrosion, and the terrible losses it can cause. And the dice are loaded the wrong way: sun, sand, salt air and polluted atmospheres will probably be helping corrosion.

With so much at stake, ordinary paint is not good enough. International's specially formulated coatings are the result of world-wide experience. If you need assured protection from corrosion, specify International.

International Paints Ltd.

Head Office: GROSVENOR GARDENS HOUSE, LONDON, S.W.1

TELEPHONE: TATE GALLERY 7070 (15 LINES)

TELEGRAMS, INLAND: CORROFOIL, SOWEST, LONDON. OVERSEAS: CORROFOIL, LONDON

REGISTERED TRADE MARK

MAIN FACTORY IN U.K.—FELLING-ON-TYNE

ASSOCIATED FACTORIES IN

AUSTRALIA	MELBOURNE	FRANCE	ROUEN	NEW ZEALAND	AUCKLAND
AUSTRALIA	SYDNEY	GERMANY	HAMBURG	NEW ZEALAND	WELLINGTON
BRAZIL	RIO DE JANEIRO	ITALY	GENOA	SPAIN	BILBAO
CANADA	MONTREAL	ITALY	TRIESTE	SWEDEN	GOTHENBURG
CANADA	VANCOUVER	JAPAN	KOBE	U.S.A.	NEW YORK
DENMARK	COPENHAGEN	MEXICO	MEXICO CITY	U.S.A.	SAN FRANCISCO
FRANCE	LE HAVRE	NORWAY	BERGEN	VENEZUELA	MARACAIBO

A WORLD-WIDE PAINT ORGANISATION

NT3922a

BY APPOINTMENT TO H.M. THE QUEEN
SUPPLIERS OF FIRE EXTINGUISHERS
THE PYRENE COMPANY LIMITED

Complete Fire Protection For Oil Refineries and Chemical Plants

Oil, in its many stages of processing—distillation, cracking, separation and refining—is a subject of constant study by Pyrene chemists and fire safety engineers. Through years of unrivalled experience we have evolved a complete range of modern fire fighting equipment to meet the various fire dangers that are always present in every branch of the oil industry. In the production of aviation and motor spirit, kerosene, fuel and lubricating oils, bitumen, petroleum chemicals, alcohols and solvents, and in the increasingly wide uses of these products in industry, there are no fire problems beyond the scope of "Pyrene" Fire Protection.

An investment Pyrene TRADE MARK FIRE PROTECTION *in peace of mind*

You should know about important "Pyrene" developments. Write Dept. W.P.10

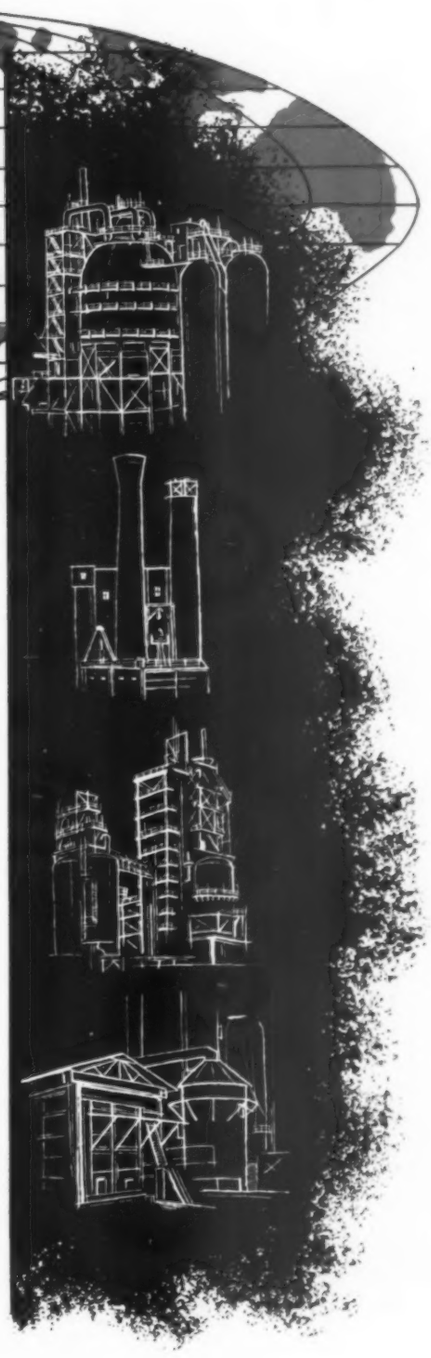
THE PYRENE COMPANY LIMITED

9 GROSVENOR GARDENS • LONDON S.W. 1. • ENGLAND *Cables:* 'PYRENE' LONDON

Head Office & Works: GREAT WEST ROAD • BRENTFORD • MIDDLESEX • ENGLAND

CANADIAN PLANT: *Pyrene Manufacturing Company of Canada Limited, 91 East Don Broadway, Toronto, 8.*

THROUGHOUT THE WORLD...



Serves the Petroleum Refining Industry with a Complete Line of High Quality Refractory Products

The petroleum industry, throughout the world, relies on A. P. Green high quality refractories for dependable service in thermal and catalytic cracking units, heaters, boilers, stacks, et cetera.

A world-wide network of A. P. Green distributors with engineers experienced in petroleum refining is always ready to help you select the right refractories to do the best possible job . . . at the lowest cost. For one dependable source of a complete line of refractories write . . .

A. P. Green
REFRACTORY
PRODUCTS

A. P. GREEN FIRE BRICK COMPANY
Mexico, Missouri, U. S. A.

PLANTS: Mexico, Mo. • Woodbridge, N. J. • Sulphur Springs, Texas • Jackson, Oak Hill, South Webster, Ohio • Philadelphia, Pa. • Troy, Idaho

In Canada: **A. P. GREEN FIRE BRICK COMPANY, LTD.** Toronto 15, Ontario

In England: **LIPTAK, LTD.** London, England

Distributors in the Principal Cities of the World

Forged Steel Fittings

Now protected with...

new blue rustproof coating

That attractive color you see on our forged carbon steel fittings is a new synthetic coating that effectively protects the fittings against corrosion in stock and in service. The coating completely covers the fittings—inside and outside, thus protecting threads and sockets, as well as external surfaces.

If you are going to paint your piping system for color coding or other reasons, the new coating serves as an excellent base for paint. No objectionable rust or scale to scour off before painting.

All W-S forged carbon steel fittings, in both screw-end and socket-welding types, are now available with the new blue rustproof coating.

Remember the blue color. It labels the fitting a W-S Quality Product.

Send for your copy of Forged Steel Fittings Catalog A-3-56

H. K. PORTER COMPANY, INC.

W-S FITTINGS DIVISION

PORTER DIVISIONS: CLEVELAND • CONNORS STEEL • DELTA-STAR ELECTRIC • Henry DISSTON • LESCHEN WIRE ROPE • QUAKER RUBBER REFRACTORIES • RIVERSIDE-ALLOY METAL • VULCAN CRUCIBLE STEEL • W-S FITTINGS • H. K. PORTER COMPANY (CANADA) LTD.

Now... at 1/10 the cost... a better

ANTI-STALLING ADDITIVE

GULF AGENT 178

... proved by over 25 billion miles of stall-free driving!

GULF AGENT 178 provides economic, effective anti-stalling performance in motor gasolines. At the same time, it affords corrosion protection at no extra cost.

Look at what GULF AGENT 178 offers you:

PROVED PERFORMANCE—GULF AGENT 178—long recognized as an outstanding corrosion inhibitor for all types of petroleum products—is now used by major refiners in modern volatile motor gasolines to eliminate stalling caused by carburetor icing . . . and its effectiveness for this use has been proved in service by over 25 billion miles of stall-free driving.

LOW COST—Small concentrations—15 to 25 pounds per thousand barrels—give anti-stalling protection at as low as 1/10 the cost of commonly used de-icing additives.

EASE OF USE—GULF AGENT 178 is readily soluble in all petroleum products—can be easily blended at temperatures ranging from minus 30 to plus 140° F. Also, it is insoluble in water and can be handled in conventional gasoline transfer systems with no danger of loss from water leaching.

MINIMUM STORAGE—The small concentrations required eliminate need for expensive additive storage.

EXTRA BENEFITS—Rust protection it provides lengthens life of distribution and storage facilities from refinery to customer.

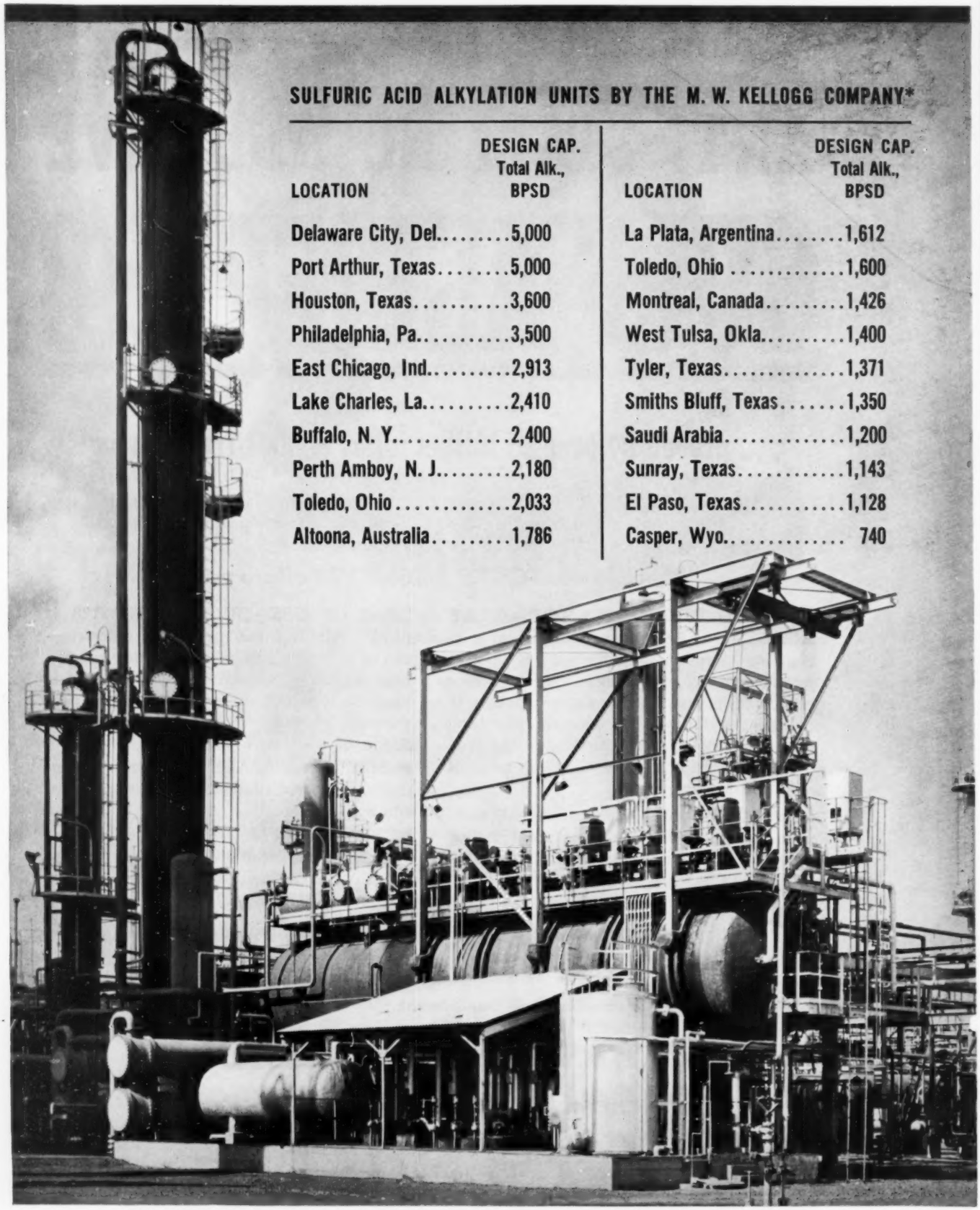
Let us demonstrate GULF AGENT 178 in your gasoline!

Petrochemicals Department
GULF OIL CORPORATION
Gulf Building
Pittsburgh 30, Pennsylvania

QUALITY CHEMICALS *from* PETROLEUM

GULF®

Today's Ultimate



SULFURIC ACID ALKYLATION UNITS BY THE M. W. KELLOGG COMPANY*

LOCATION	DESIGN CAP. Total Alk., BPSD
Delaware City, Del.	5,000
Port Arthur, Texas	5,000
Houston, Texas	3,600
Philadelphia, Pa.	3,500
East Chicago, Ind.	2,913
Lake Charles, La.	2,410
Buffalo, N. Y.	2,400
Perth Amboy, N. J.	2,180
Toledo, Ohio	2,033
Altoona, Australia	1,786
La Plata, Argentina	1,612
Toledo, Ohio	1,600
Montreal, Canada	1,426
West Tulsa, Okla.	1,400
Tyler, Texas	1,371
Smiths Bluff, Texas	1,350
Saudi Arabia	1,200
Sunray, Texas	1,143
El Paso, Texas	1,128
Casper, Wyo.	740

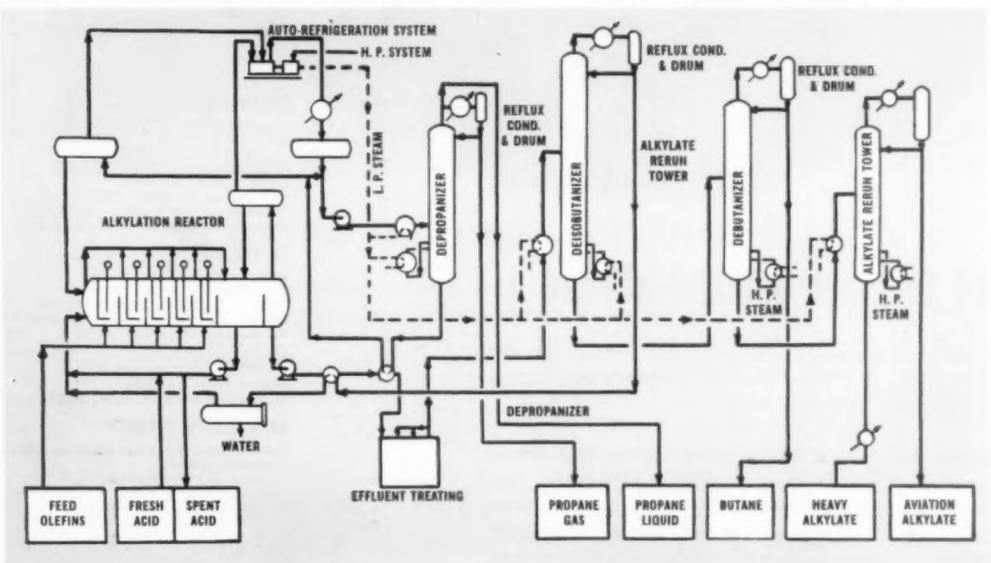
*List shows only units utilizing Kellogg's Cascade Reactor. Kellogg has also engineered and built many alkylation units of other types.

in ALKYLATE . . .

Measured by every standard . . . by quality and quantity of yield . . . by initial investment . . . by operating costs . . . M. W. Kellogg's sulfuric acid alkylation process is bringing optimum results to an increasing number of leading refiners both at home and abroad.

With its present advanced design, utilizing the company's unique multiple-stage cascade reactor and auto-refrigeration system, Kellogg alkylation offers the ultimate today in high isobutane efficiency, low acid consumption, low outlay for recycle and auxiliary equipment, and low utilities cost.

The M. W. Kellogg Company welcomes the opportunity to describe this alkylation process in detail, and to acquaint refiners with the improvements its engineers are continually making toward still greater economy and efficiency.



Refinery Process Division

The M. W. Kellogg Company

711 Third Avenue, New York 17, N.Y.

A SUBSIDIARY OF PULLMAN INCORPORATED

The Canadian Kellogg Company Ltd., Toronto • Kellogg International Corp., London • Kellogg Pan American Corp., New York • Societe Kellogg, Paris • Companhia Kellogg Brasileira, Rio de Janeiro • Compania Kellogg de Venezuela, Caracas

Now made abroad to meet demand abroad

High standards of quality and performance have long been responsible for the frequency with which our products are specified by the petroleum industry in the United States, Canada and Latin America.

Now the same efficient gauges, safety and safety relief valves, pneumatic transmitters, and steel valves are being produced in England, France, Belgium, Western Germany and Italy by companies well-known for precision manufacture. These licensees help to assure global availability of quality products bearing our brand names, *with payment acceptable in the currencies of those countries.*

Each of our licensees is unreservedly qualified to assist you in selecting the right types of industrial instruments and valves for your particular needs. We invite you to obtain from them specific product information for both new installations and facilities now in operation. Or write our Export Division as noted below.

IN ENGLAND

Dewrance & Co. Ltd., London, S.E. 1
Ashcroft Duragauges
Ashcroft Pneumatic Transmitters
Consolidated Safety Relief Valves
Consolidated Safety Valves
Consolidated "Maxiflow" Safety Valves
Consolidated "Electromatic" Relief Valves
Hancock 800# Type 950 Steel Gate Valves

IN FRANCE

SAPAG, Paris
Consolidated Safety Relief Valves
Hancock 1500# and 2500# Steel Valves
Hancock 800# Type 950 Steel Gate Valves
Hancock Steel "Flocontrol" Valves

IN BELGIUM

Ateliers Jaspar, S.A., Liege
Consolidated Safety and Safety Relief Valves

IN WESTERN GERMANY

Deutsche Babcock & Wilcox Dampfkessel-Werke, Oberhausen (Rheinl)
Consolidated Safety Relief Valves
Consolidated Safety Valves
Consolidated "Maxiflow" Safety Valves
Consolidated "Electromatic" Relief Valves

IN ITALY

Societa Carraro & Co., Milan
Consolidated Safety Relief Valves
Hancock Temperature Regulators
Filotecnica Salmoiraghi—SPA, Milan
Ashcroft Duragauges
Ashcroft Pneumatic Transmitters

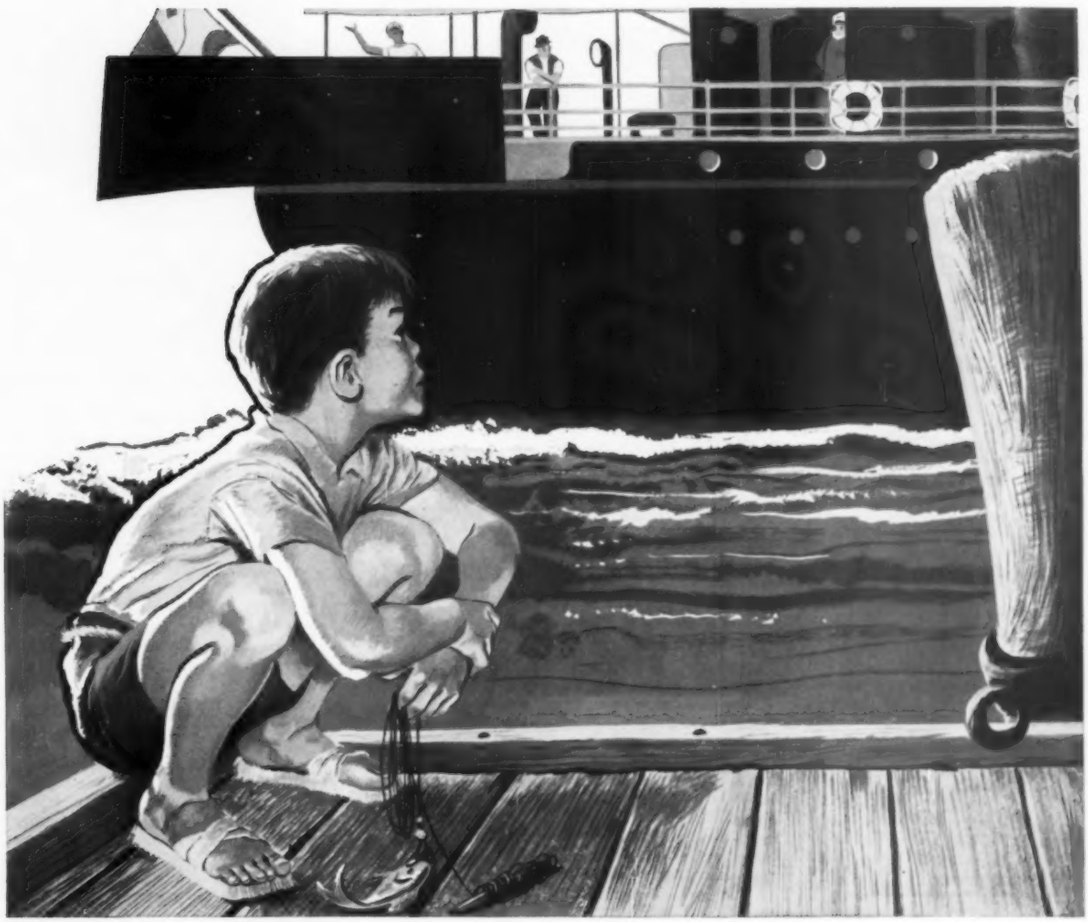
IN CANADA

Manning, Maxwell & Moore of Canada, Ltd., Galt, Ontario
Ashcroft Gauges
Consolidated Safety and Safety Relief Valves
Hancock Bronze and Steel Valves

MANNING MAXWELL & MOORE INC. TRADE MARK

MANNING, MAXWELL & MOORE, INC.

Export Division • Chrysler Building East, New York, New York, U. S. A.



a cargo of hope for him

This is a special kind of ship, and it meets a special kind of need. It is the need you see everywhere these days throughout Asia, Africa and the lands of the Pacific – the demand for power machines to do work better and faster.

Throughout this vast area Standard-Vacuum tankers are plowing the seas as you read this, deep-laden with the petroleum required for new industry. Stanvac finds the oil, transports it, refines it and gets it to those who want it – all within the area where Stanvac operates.

These peoples are resolved to build a new kind of life for themselves and their children. Today they dream of food and clothing and shelter enough for everybody. And Stanvac is doing its best to help them make that dream come true.

STANDARD-VACUUM OIL COMPANY **POWERS PROGRESS**

White Plains, New York

Latin American Oil News

Aguasay Caro No. 2 Completed in Venezuela

The Atlantic Refining Co. and the Pancoastal Petroleum Co. have announced completion of their Caro No. 2 well in the Aguasay area of the state of Monagas, Venezuela. This well drilled to a depth of about 13,665 ft, has been tested at 1,554 b/d of 32 API oil through a ¼-in. choke. An upper zone at about 12,600 ft was also tested earlier with a potential of 862 b/d through a ⅝-in. choke.

Atlantic and Pancoastal, which jointly hold approximately 13,500 acres in this area, announced completion of their Caro No. 1 on March 14 of this year.

Mexican Oil Production Rise in Tabasco

Within two or three months, production of Pemex' "southern zone," in the Tabasco swamplands, will reach 40,000 b/d, it is predicted by Director Antonio J. Bermudez. In a statement announcing that Ogarrio No. 2 had been brought in with a daily output of 945 bbl, Pemex said:

"Ogarrio No. 2 is 800 meters from No. 1 and 17 km from La Venta, first field discovered by Pemex in this region. Ogarrio No. 1, the new field's discovery well, came in as a producer in May of this year.

"In the course of 1,810 meters of drilling, Ogarrio No. 2 crossed four layers of oil sands, with a combined thickness of 90 meters. Its first test, covering only 19 meters at the bottom of the deepest sands, yielded 150 cubic meters of very light oil in 24 hours.

"With this new well, production in the area is now 35,500 b/d."

New Argentine Refinery

The National Power Board has approved Esso Standard's expansion program for construction of a 47,000 b/d pipe still and 17,000 b/d fluid catalytic cracking unit at Esso's Campana refinery.

Home of the Famous

Petroleum Club

100% air-conditioned

Peru Strike

Cia. Peruana de Petroleo "El Oriente" plans to drill three more wells in the jungle area of Peru after finding oil in Maquia No. 2 well.

The No. 2 well began to flow, July 14, after 2,200 ft, at a rate of 500 b/d. The oil is reported to contain a high potential percentage of gasoline, kerosine, and heavy oils, and low paraffin.

Marquia No. 1 well began to flow March 11 of this year, at about the same rate, and was the first production of new oil in the jungle area. The third well was to be started during August. An access road has been built and drilling equipment moved in.

A pipeline from the Maquia wells to the Ucayali River, about 7 km, in planned if the oil reserves prove sufficient to justify commercial exploration.

Mexican Concessions Cancelled

Three Mexican oil concessions held by Balbino Vidal, the France-Mexico Oil Co., and Benito Ancira & Partners have been cancelled and assigned to the federal treasury, in accordance with a decree issued by the Economy Ministry.

Benito Ancira & Partners had been granted exploration and development rights on 40,974 hectares at Trevinos, in the state of Nuevo Leon; France-Mexico's similar title covered 30 hectares and 3,000 square meters at Panuco, Veracruz; while the holding of Balbino Vidal covered 455 hectares and 8,070 square meters at Santa Barbara, Chihuahua.

Mexican Gas Exports

For the first time in its history, Mexico is exporting natural gas, it was disclosed by Alfonso Barnetche, Pemex exploration manager. The shipments to the United States got under way, August 15, with the pumping of 126 mmcf per day from the Reynosa refinery to the border connection with Texas Eastern Transmission's pipeline to Beaumont, Texas, from which the gas is distributed to American consumption centers.

At the same time, Director Antonio J. Bermudez added, a number of domestic customers have been found for the Reynosa product in the state of Nuevo Leon, where local industries have agreed to buy the Mexican gas, which they received by pipeline, instead of that imported from the United States. This switch, according to Bermudez, will provide Pemex with an additional 90,000,000 pesos in income a year, apart from saving dollar exchange previously spent for this product.

Aluminum Pipe Under Lake Maracaibo

The floor of brackish Lake Maracaibo will be crisscrossed with 22 miles of oil-carrying aluminum pipe supplied by Aluminum Co. of America, it has been announced by Creole Petroleum Corp. Decision followed a detailed inspection of an 800-ft pilot line installed in the same waters by Creole in 1955. After two years' service, the unprotected Alcoa aluminum pipe is in excellent condition.

Pemex Ceremonies Start Gas Across Border

At special ceremonies recently, marking commencement of operations of a new natural-gas pipeline to carry major quantities of Mexican gas to the United States, Antonio J. Bermudez, director general of Petroleos Mexicanos, opened the valve on the Rio Grande River near Reynosa, Mexico, connecting Pemex facilities with a new pipeline into the USA constructed by Texas Eastern Transmission Corp., of Shreveport, La. Initially, some 115 mmcf of natural gas will flow across the international border into the USA each day, through Texas Eastern's 5,900-mile gas system which extends through central USA and terminates on the eastern seaboard near the city of New York.

Foreign guests present at August 12 meeting of Houston Chapter of NOMADS (left to right, front row): E. S. Hulsman, Shell Oil Co., Bogota, Colombia; J. T. Johnson, Creole, Maracaibo, Venezuela; and Chester H. Lauck, Continental Oil, Houston. Back row: R. R. Davila, Consul General of Venezuela, Houston; R. Ach, S. N. Marep, Paris, France; R. H. Johnson, Standard Vacuum, Polembang, Sumatra, Indonesia; and Oscar Schuberg, Cal Tex, Sumatra.

Tailor-Made Drilling Mud

A new drilling mud for faster drilling and longer bit life in Venezuela oil fields has been developed by Mene Grande Oil Co. of Venezuela. It is a new formulation of Petronate, a product of L. Sonneborn Sons Inc., and has resulted in average savings in drilling time of about 25%—with approximately 20% fewer drill bits required.

Both the new oil emulsion drilling mud, and the process of using it, are covered by a Gulf Oil Corp. patent. Nonexclusive licenses are available from Gulf Oil Corp. and L. Sonneborn. Petronate is a trade name for a family of products which derive from the sulfonate group, and a product of the Sulfonate Division of L. Sonneborn Sons Inc.

United Fruit Has Panama Concession

United Fruit Co. recently contracted to acquire the rights to a concession granted by the republic of Panama to explore for petroleum over an area of more than one million acres. Action was announced in a letter to company shareholders by Kenneth H. Redmond, president. The concession is situated in the province of Chiriqui on the Pacific Coast of Panama, where United Fruit has been doing business for many years, and where some of the company's first banana plantations are located.

Creole Produces 1,102,849 B/D

Creole Petroleum Corp. reports Venezuelan daily average crude production in July of 1,102,849 bbl. Rigs operating averaged 20.4—of which 12.9 were development and 7.5 exploratory. Oil wells totaled 13; no gas; 2 dry holes; 10 suspended—for a total of 25. Crude refined at Caripito averaged 88,865 b/d in July, and at Amuay 277,041 b/d.

NEW DRILLING BARGE, the "W. F. Youngblood", was built by Levingston Shipbuilding Co. for Producers Drilling Co. Machinery was furnished by Mid-Continent Supply Co. The barge is a slotted-type unit designed to drill to 20,000-ft depths. It will operate in water up to 17 ft.

Over
70
Locations in the United States and Canada

McCullough® REPORTS TO THE OIL INDUSTRY

Service
Anywhere Anytime

New Services • • • New Tools • • • New Methods • • • Outstanding Results

Powerful M-3's Perforate Deep Well for 1296 B/D

McCullough M-3 Bullet Guns Get Production After Jets of Another Make Fail

This deep well in New Mexico had previously been jet perforated by another service company without results.

Producing formation was a 26′ zone between 11,977′ and 12,003′. 5½″ OD 20 lb. casing had been cemented through the zone.

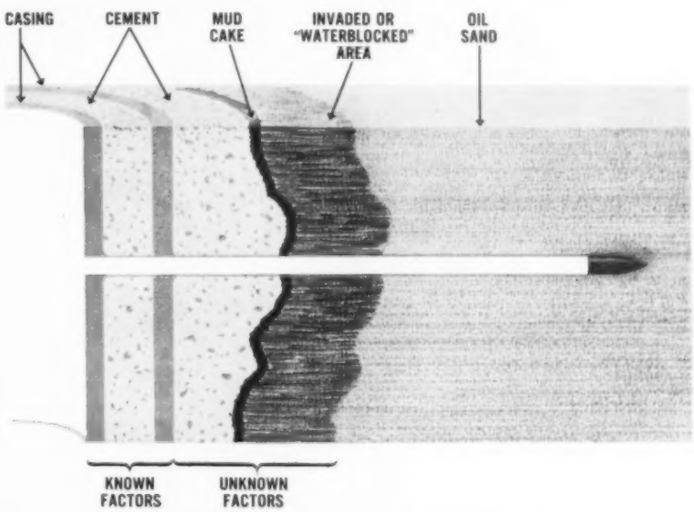
McCullough was called to reperforate the well with M-3 Bullet Perforators. 156 improved ½″ Ogival Bullets, six per foot, were fired in the 26′ interval.

Resulting production was 1296 barrels of oil per day. Operator was very pleased with the good results of the job.

McCullough M-3 Bullet Guns are made to shoot harder—to obtain deepest penetration under severe well conditions. M-3 Guns will get production or increase production even after others have failed.

The job shown above is certified to be a true field report of service rendered.

For full information on the McCullough M-3 Bullet Perforator, write to:
McCullough Tool Company
5820 South Alameda
Los Angeles 58, Calif.



HARDEST SHOOTING M-3 BULLET GUNS
"PUT THE SHOTS WHERE THEY COUNT"—DEEP IN THE OIL ZONE

M-3 Guns are designed to obtain the deepest possible penetration. They have the extra firing power necessary to pierce the known thickness of multiple casing strings with cement in the annulus—to penetrate through an unknown thickness of cement outside the casing—to get through the variable depth of a mud cake and "water blocked" area—to penetrate deep out into the virgin oil zone.

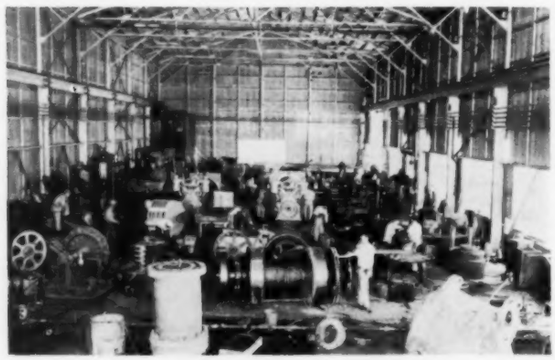
Because they shoot harder, McCullough M-3 Guns get the results you want—better production—more oil! Size for size, M-3's consistently outshoot all other makes of bullet guns.

McCullough® TOOL COMPANY
Cable Address: MACTOOL

LOS ANGELES
HOUSTON
EDMONTON

a new high in prompt service . . .

from **AVONDALE**

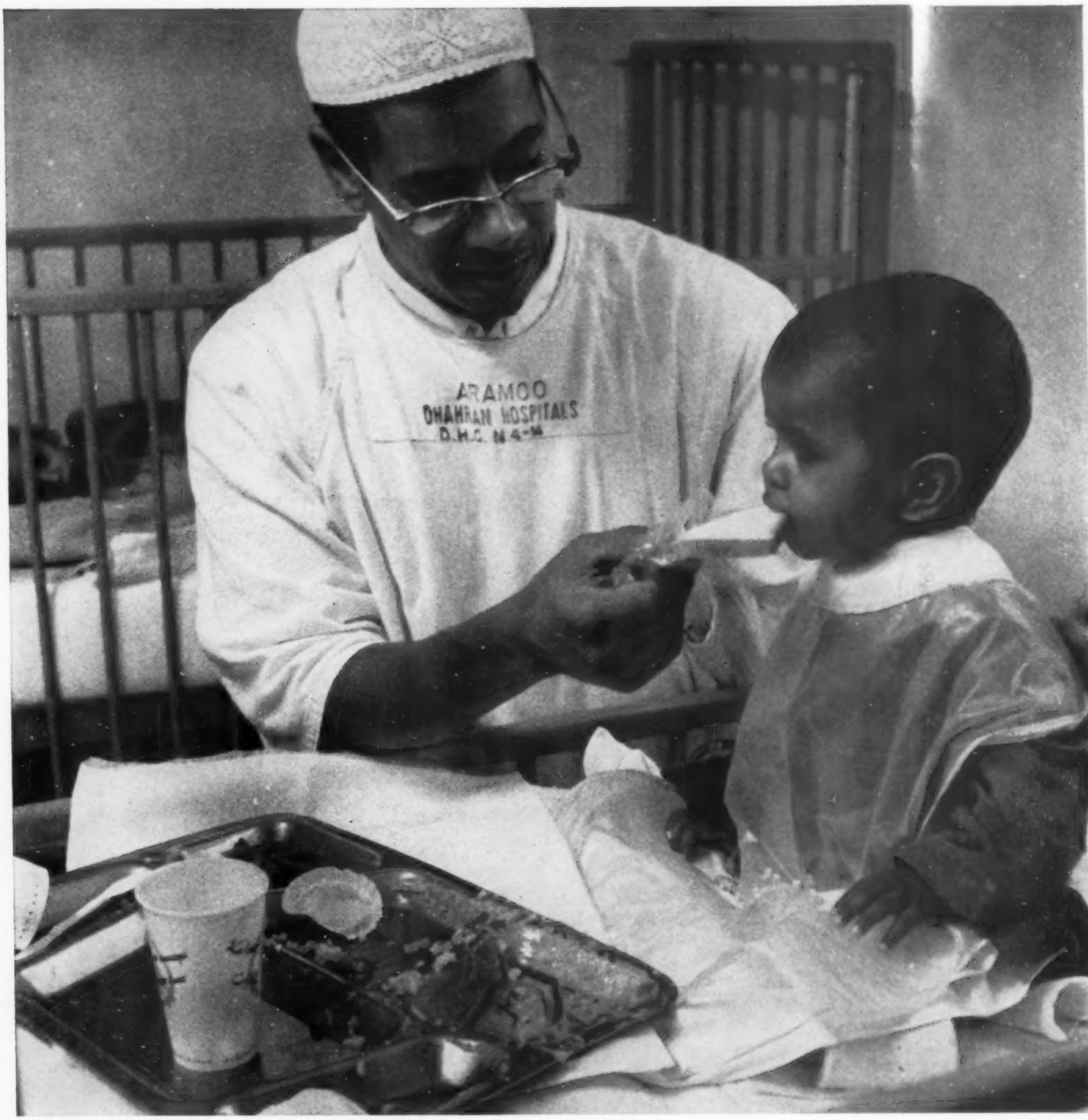


For speedier customer contacts throughout the oil country . . . Avondale now has available a 265 h.p. Helio-Courier seaplane for Sales and Service coverage. This means a new high in Avondale's "prompt service" tradition. We are prepared, as always, to meet your most exacting requirements on construction and repair of oil drilling equipment. Our entire integrated facilities, including our Oil Tool Department and modern Electric Shops, are at your disposal . . . 24 hours of every day.

SHIP BUILDING · SHIP REPAIRING · FOUNDERS · PROPELLERS · STRUCTURAL STEEL

AVONDALE MARINE WAYS, INC. CABLE ADDRESS "AVONWAYS"

P. O. BOX 1030 • PHONE UNiversity 6-4561 • NEW ORLEANS 8, U. S. A.



"Every major decision that an investor make: is a bet on the future. And that involves trust and good faith. Businessmen must have assurance that ground rules are not going to be changed halfway through the game. American capital wants no preferred position, no advantage over the nationals of the host country. What is good for the people of the host country is good for the American investor."

—Eugene Holman, Chairman of the Board, Standard Oil Company (New Jersey)

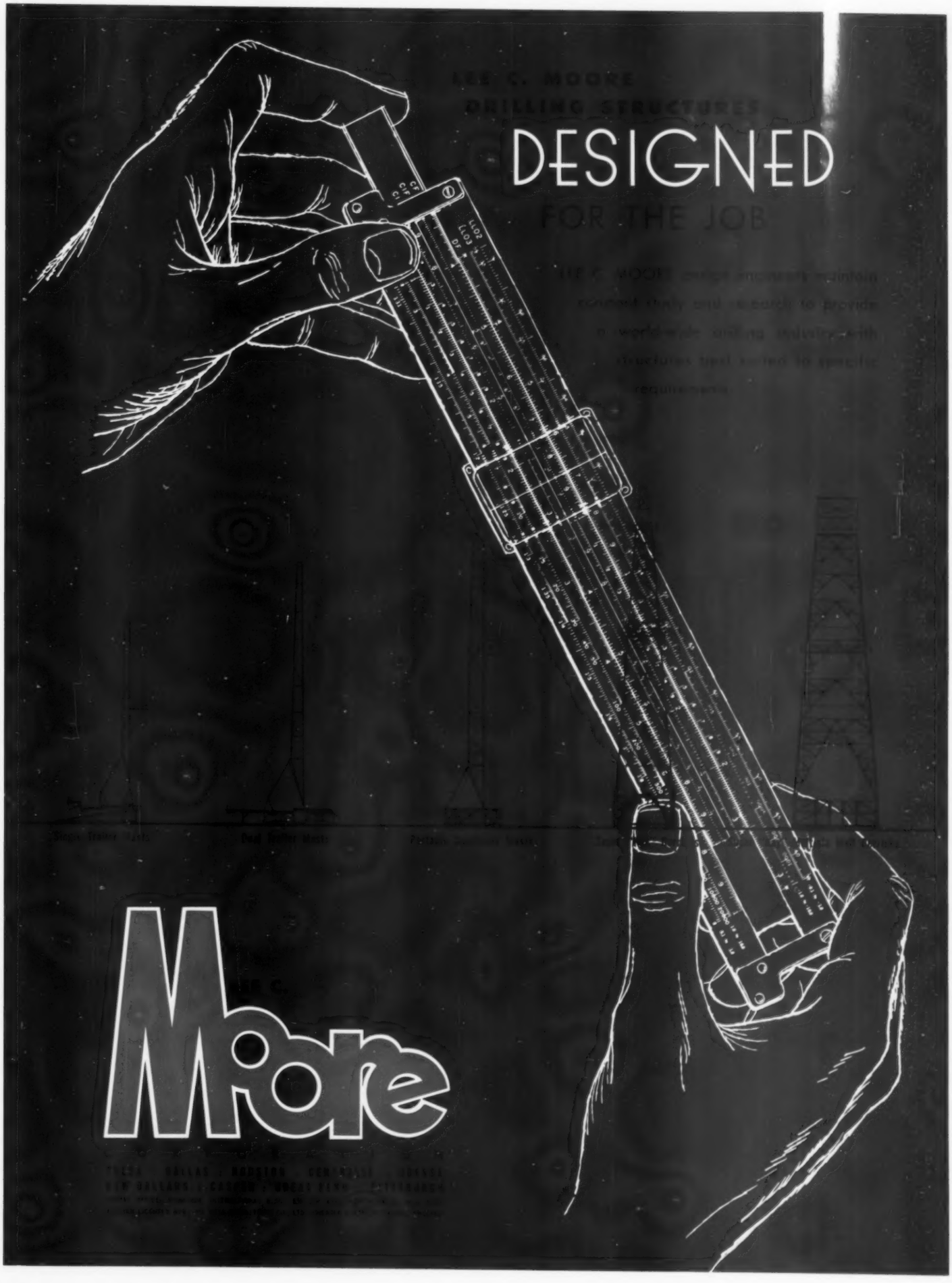
ESSO 75 YEARS

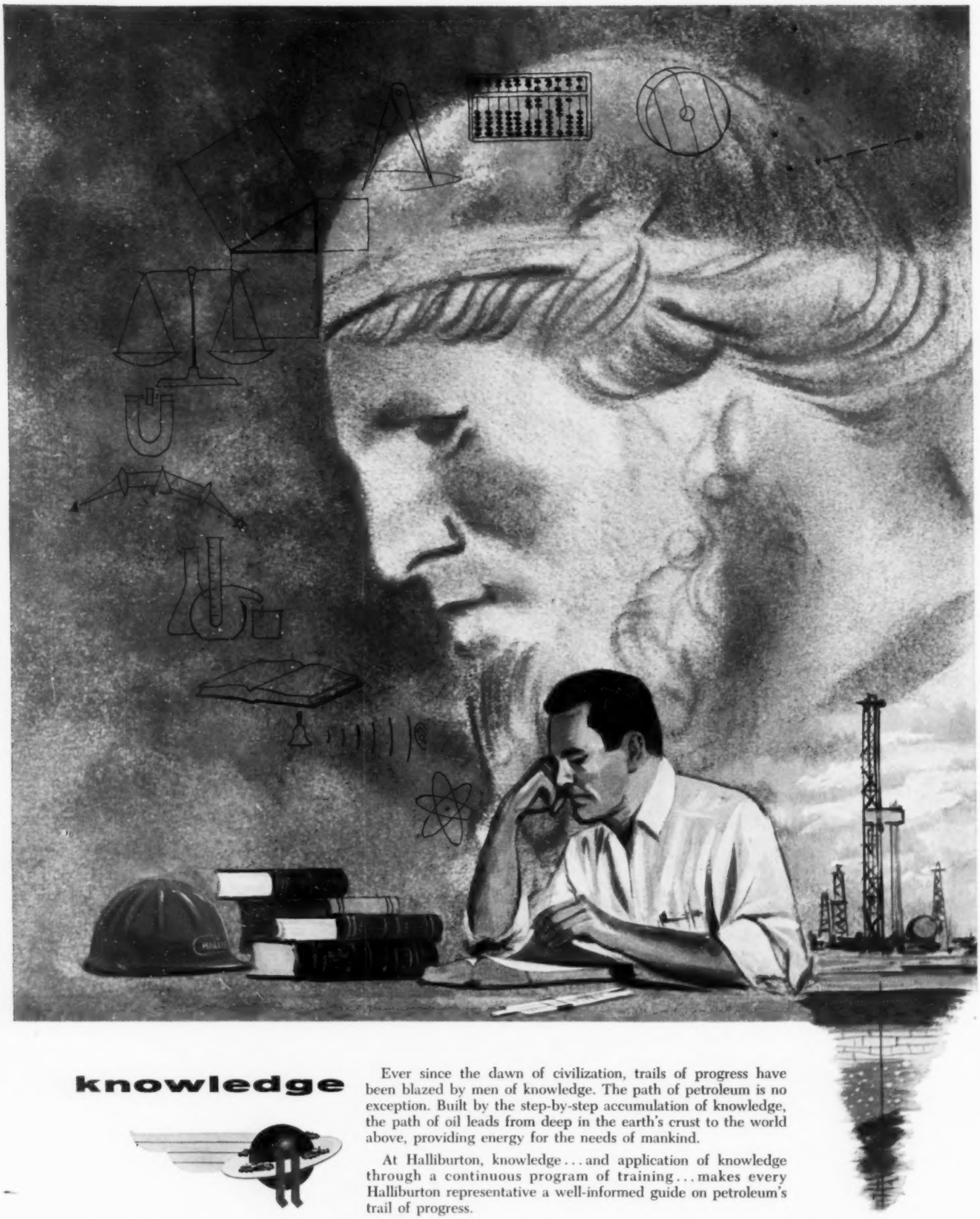
producing energy for an abundant life

STANDARD OIL COMPANY (NEW JERSEY)

AND AFFILIATED COMPANIES

G.E.C.
FLAMEPROOF
'LITEALARM'
an essential
safety device...
RESET
TEST
... wherever an
explosion hazard
exists
Used with auxiliary alarm equipment, the 'Litealarm' gives visual warning and will operate audible warning apparatus under abnormal conditions, such as high temperatures, excessive pressures, motor over-speed and dangerous level of tank fluids. Easy to install and simple to operate. Full details available on request.
FOR MINES, POWER PLANTS, OIL REFINERIES AND SIMILAR INSTALLATIONS. CONFORMS TO B.S.S. 229 GROUPS I, II AND III.
G.E.C.
THE GENERAL ELECTRIC CO. LTD. OF ENGLAND, MAGNET HOUSE, KINGSWAY, LONDON, ENGLAND


DESIGNED
FOR THE JOB
Moore



knowledge

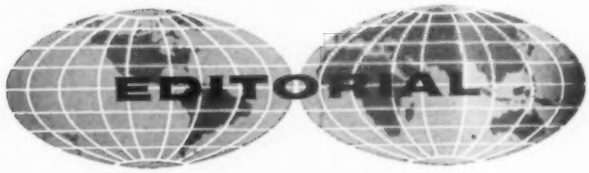
Ever since the dawn of civilization, trails of progress have been blazed by men of knowledge. The path of petroleum is no exception. Built by the step-by-step accumulation of knowledge, the path of oil leads from deep in the earth's crust to the world above, providing energy for the needs of mankind.

At Halliburton, knowledge... and application of knowledge through a continuous program of training... makes every Halliburton representative a well-informed guide on petroleum's trail of progress.

HALLIBURTON OIL WELL CEMENTING COMPANY

DUNCAN, OKLAHOMA

Primary Cementing . . . Remedial Cementing . . . Cementing Equipment . . . Drill Stem Testing . . . Electrical Well Logging . . . Formation Fracturing . . . Chemical Services



Who? Me!

Prime object of the President's "voluntary" program for restricting crude imports into the United States is to increase the allowable production of domestic crude, which suffers in competition with Middle East oil at East Coast destinations. Assuming that the program is a success, it is logical to expect that markets will become firmer.

Early in the year, when United States crude prices were advanced during the Suez crisis, refiners increased their posted prices for motor fuel and other finished products. Such increases were, of course, justified by the higher level of crude prices. This did not prevent a public outcry by certain public officials. Demands were made for government price fixing and other controls.

The higher markets did not hold. Gasoline prices fell very quickly, and furnace oils were not far behind. Reasons for the failure of markets to hold are not difficult to ascertain. Gasoline stocks were high, and refiners were anxious to unload. Weather was warm, and distillate demand was disappointing.

This winter, with imports of crude by East Coast refiners restricted, there will be a strong economic urge to restore wholesale and retail prices to a profitable level. This can be done by cutting crude runs for a reasonable period in order to reduce inventories to a more satisfactory level. Once this is accomplished, the markets automatically will take on a more healthy tone. It will become possible to earn a reasonable profit by processing light domestic crudes.

Independent producers in the southwest complain that, even after this year's crude advance, the price of oil is not high enough to earn a profit because of the impact of the inflationary spiral on the cost of steel products and labor. With the competition of imported crude limited by Presidential fiat, the Independents will become more voluble in their requests for higher crude prices. If a satisfactory level for crude markets is reached, another round of retail price advances will be inevitable.

Before these events take place, the industry should pause to reflect on the consequences. The effect on public relations is easy to foresee. There will be an outcry on the part of members of Congress and other politicians.

Will this protest against higher prices be directed at the national administration? Of course not. Blame will be laid at the door of the "predatory" major oil companies which posted the higher prices for crude, as needed by Independent producers, and at the door of refiners who passed their higher raw-material costs on to the public.

Public opinion groundwork should be laid before effects of the "voluntary" import restrictions become evident. The industry should begin patting itself on the back for its cooperation with the National Administration in shutting out cheap or foreign competition. This theme probably can be developed most effectively on the basis of national defense upon which the government has based its request for lower imports. Concurrently, it is desirable that the industry tell the public the facts about how much more expensive it is today to find and lift a barrel of new oil. There is solid meat here. Steel costs are higher; wells are deeper, and require more steel to case and equip once the oil is found. Labor costs are higher. To produce the high-octane gasoline needed by today's new cars, oil refiners require more processing units than a few years ago. Platinum costs for charging a catalytic reformer are fantastic. Every type of unit costs more to build.

Early this year, crude prices were advanced with little or no preparation of the public mind. The result was not happy. The industry had to rush down to Washington with facts and figures to put out the fire. Criticism was allayed, but the industry had been damaged. With a preliminary program involving talks by oil leaders in various public forums and other forms of publicity, the facts can be stated before the crisis arises. When markets do improve, the industry can rest on the premise that it has incurred higher costs through its cooperation with the government and that in all fairness it is entitled to higher prices to meet these costs.

When the finger is pointed, the oil industry can reply: "Don't blame us. We are only doing what the government holds is our patriotic duty." END

Qal
Tra
Rb
Jbs
Kat
Kg
TQt
TQv
I
I reported
Mantled
DA
0 1/2 1 2 KM
0 1/2 1 2 MILES

PHOTOGEOLOGY

speeds Libyan exploration

by Laurence Brundall

THE current accelerated exploration program in Libya provides an ideal case history for the step-by-step utilization of air photographs to provide geologic and other data on a large area in a fraction of the time which would be required to get the same data by ground observations.

The kingdom of Libya comprises approximately 680,000 square miles. Of this, about 650,000 square miles are sedimentary areas having some potentiality for oil or gas. Concessions totaling in excess of 207,000 square miles are held by 11 oil companies. Although the surface geology over portions of the sedimentary belt is obscured by mantle deposits of sand and gravel, large areas are amenable to photogeologic techniques, and most of these companies are realizing the advantages of the airphoto approach to their exploration programs.

Photogeologic evaluation in Libya can be divided into four stages:

Stage I: regional evaluation using existing trimetrogen coverage.

Stage II: reconnaissance evaluation using small-scale full vertical coverage with supplementary larger-scale split obliques.

Stage III: detailed qualitative evaluation using larger-scale, full vertical coverage.

Stage IV: quantitative photogeology by means of high-order photogrammetric plotting instruments.

Since these four stages are also applicable to many other areas of foreign petroleum exploration, they are discussed below in more detail.

Fig. 4 Photogeologic interpretation of the WADI GAN area, northwest Libya: Qal—*recent flood plains, alluvium and mantle.* TQt—*Tertiary-Quaternary terraces.* TQv—*Tertiary-Quaternary volcanic flows.* Kg—*Garian Is.* Kat—*Ain Tobi Is. (includes Jefren marl).* Jbs—*Bu Sceba group.* Tra—*Azizia fm.* Trb—*Boutoniere fm.* I—*Intrusive. (Nomenclature from A.M. Christie, chief geologist, American Overseas Petroleum, Tripoli; mosaic prepared from Fairey Air Surveys Ltd. photography).*

Stage I—Regional Evaluation: The trimetrogon system of photography and mapping was extensively used during, and immediately following, World War II. Since the technical details of the trimetrogen system have been described in numerous articles, only a brief description is given here.

Fig. 1 shows the basic setup. The photographs are taken by three cameras having 6-in. lenses and with coordinated shutters. One camera is mounted for vertical photographs, and the other two are inclined at 60 deg from the vertical to obtain right and left obliques. The oblique cameras yield photographs which overlap the edges of the verticals, and include the horizon. In this manner, a single trimetrogen exposure provides horizon-to-horizon coverage. Most trimetrogon photography was taken from a height of 20,000 ft above the terrain—thus yielding a scale of 1/40,000 in the vertical portions, but with very small scales in the distant portions of the oblique photographs.

This photography was never intended for use in detailed photo interpretation studies, but as a very rapid method of making military maps. However, since large portions of the earth's surface were covered by trimetrogon photography, the photogeologist has used this coverage for rapid regional evaluation in areas where better photography is lacking.

This situation applies to Libya and, in one project, an area of approximately 340,000 square miles was mapped photogeologically in a year. The trimetrogen photography provided fair detail in the vertical photographs, but the oblique portions allowed delineation of only the major geologic features. Prominent features such as fault scarps are apparent on the obliques. Bedding attitudes can be determined accurately if the strike is approximately at right angles to the line of flight, and only then if the dip is greater than 2 deg or 3 deg.

Fig. 2 shows the relative reliability of photogeologic evaluation from trimetrogon coverage.

Stage II—Reconnaissance Evaluation: Following the trimetrogen stage, many foreign areas have been covered by full vertical small-scale (approximately 1/60,000) photography. Here again the emphasis is on coverage designed for rapid map compilation rather than detailed photo interpreta-

LAURENCE BRUNDALL, vice president of Geophoto Services Inc., Denver, Colo., attended the University of Melbourne, Australia, and the University of Chicago, where he majored in geology. Following some graduate work at Chicago, he was employed by Shell Oil Co. from 1936 to 1942 as an exploration geologist in the Texas-Gulf Coast area. In 1942 he received a commission in the US Navy, as a photographic intelligence officer. Upon discharge in 1945, he was co-founder of Geophoto Services Inc., which has undertaken photogeologic and surface-mapping projects in 19 countries outside the United States.

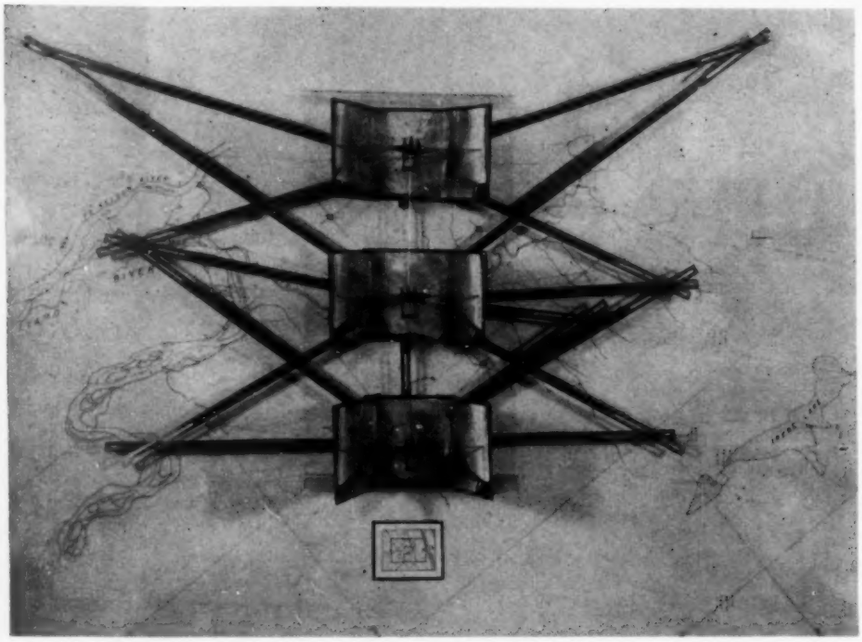


Fig. 1 Trimetrogon compilation model: The projecting rays are control points on oblique photographs (US Geological Survey photo).

tion studies. Since this coverage allows photogeologic evaluation of full vertical photographs, it is superior to trimetrogen coverage—although the small scale prohibits detailed analysis, especially in low-dip areas. At the present time, approximately 100,000 square miles in Libya are covered by this small-scale photography, and similar coverage is contracted for in additional areas.

The main advantages of this small-scale photography are:

a. Provides source material for rapid and inexpensive mosaic and planimetric map construction.

b. Allows rapid reconnaissance photogeologic evaluation.

c. Contact prints or enlargements provide valuable terrain and accessibility data for use by geological and geophysical parties.

The existing 1/60,000 coverage in Libya is accompanied by special oblique photographs which were exposed at the same time. The setup resembles trimetrogon coverage in that a vertical camera and left and right oblique cameras were used. However, the vertical camera has a 6-in. focal length lens which produces 1/60,000 vertical coverage at a plane height of 30,000 ft above the ground, and the oblique cameras have 12-in. focal length lenses with the camera axes inclined 12½ deg from the vertical. The 12-in. lenses produce a scale of 1/30,000 on the near portions of the oblique coverage. The net results of this system afford complete vertical coverage at the 1/60,000 scale, and also complete 12½-deg oblique coverage at 1/30,000 scale. The oblique coverage can be used for more detailed stratigraphic delineation, but the 12½-deg inclination of the camera axis prohibits accurate estimation of low dips.

Most of the current photogeologic evaluation in Libya is in Stage II.

Stage III-Detailed Evaluation: The initial use and great advantage of photogeology has been in rapid, large-area, reconnaissance evaluation. This applies to almost any area, including domestic areas such as they Rocky Mountain region, where intensive photogeologic work has been going on for more than 10 years. However, the amount of detail provided by the "reconnaissance" phase is much greater in the USA than in foreign areas.

When reconnaissance evaluation began in the Rocky Mountains, very little 1/20,000-scale photography was available, and the interpretation at that time was mainly limited to use of smaller-scale photographs obtained during the war years. Pioneer photogeologists in the area quickly realized the limitations of the small-scale coverage even for reconnaissance work and, within a short time, scales of 1/20,000 and 1/31,680 became standard. Although interpretation of this photography in the Rockies is still regarded by many geologists as reconnaissance work, a better term would be "qualitative interpretation," since an inspection of a typical Rocky Mountain area "reconnaissance" map being produced today would reveal an immense amount of geologic detail.

Therefore, Stage III of Libyan photogeologic work—which is also applicable to other foreign area—is equivalent to the current "reconnaissance" or qualitative interpretation now being employed in many domestic areas. At the present time, approximately 9,000 square miles in northwest Libya are covered by photography suitable for Stage III evaluation. This coverage, by a British firm, is at a scale of 1/24,000.

Fig. 3 is a reproduction of one of these contact prints. The great amount of detail on this type of photography is apparent. Fig. 4 shows the type of geologic data which can be interpreted from photography in the 1/20,000 to 1/30,000-scale range.

Following completion of the Stage II interpretation of the 1/60,000-scale contact prints, the next logical step will be more detailed evaluation of favorable areas selected from the small-scale evaluation. As mentioned previously, this would bring the Libyan photogeology up to the stage which has been employed in the Rocky Mountains for the past few years.

Stage IV—Quantitative Photogeology: Although the application of high-order photogrammetric instruments to quantitative geological mapping is not new, it has been used in a desultory manner in the past.

In domestic areas where some oil companies are approaching the saturation point

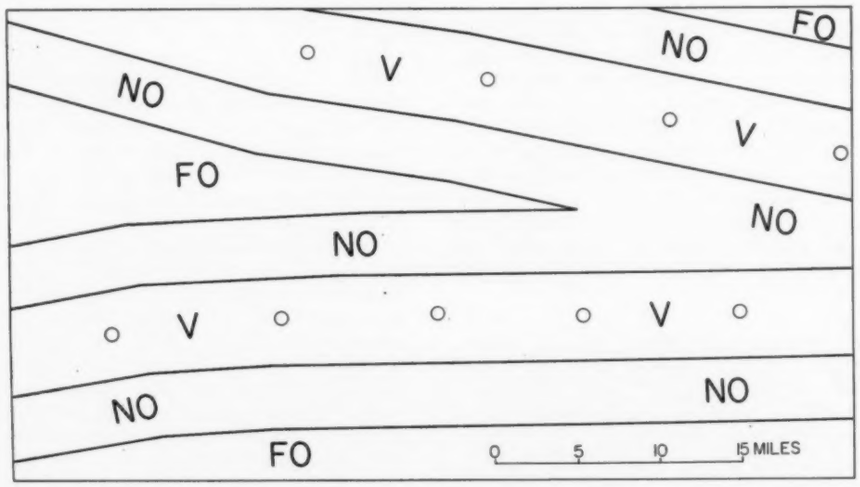


Fig. 2 Reliability index of trimetrogon coverage: V—*vertical coverage (most reliability); circles represent centers of every fifth print along flight lines.* NO—*near oblique coverage (fair reliability).* FO—*Far oblique coverage (least reliability).*

of detailed qualitative photogeology, this method is being given more consideration. It is also applicable to other domestic areas, such as the Edwards plateau of Texas and portions of Oklahoma and Kansas, where the regional dip is too low for consistently reliable qualitative dip recognition by simple stereoscopic examination.

The most suitable instrument for this type of work is the Kelsh plotter, shown in Fig. 5. This instrument uses full-scale glass plates by contact printing from the original negatives. The glass plates or diapositives are placed as shown in Fig. 5; and, by a yoke connection to the tracing table, the movable light sources project equivalent portions of each plate onto the tracing table. One light projector is equipped with a blue filter and the other with a red filter. The operator views the tracing table image with spectacles equipped with corresponding blue and red filters—with the result that a third-dimensional view is afforded on the tracing-table surface.

The great advantage of the Kelsh over the older Multiplex projector is that the projected image of portions of the full-sized diapositive is enlarged five diameters—thus allowing a large-scale steroscopic model for planimetric map construction and quantitative geological data, as well as topographic mapping.

As in all photogrammetric plotting instruments, some ground control is necessary for true orientation of the model. The ideal control for a Kelsh is five points per model —one at each corner and one in the center. A common practice in establishing Kelsh control is to use small-scale photography in a more precise instrument such as the "wild autograph." By this method less ground control is necessary and the Kelsh control is photogrammetrically determined from bridging with the more precise instrument.

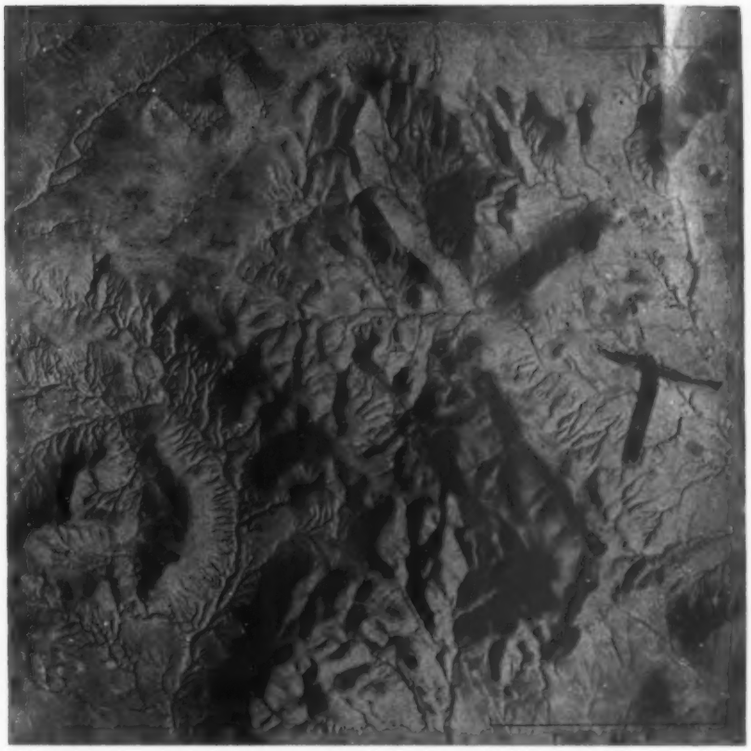


Fig. 3 Reduction of contact print covering area in northwest Libya: At original 9-in. x 9-in. size, the contact scale is 1/24,000 (1 in. equals 2,000 ft) (photo, courtesy of Fairey Air Surveys Ltd.; reproduction authorized by Libyan Public Development and Stabilization Agency).

The Kelsh has a variety of applications for quantitative photogeologic work, of which the most important are:

a. Structural contouring.

b. Precise dip and strike determination.

c. Accurate measurement of stratigraphic sections.

d. Construction of cross-sections.

e. Local and regional isopachs of exposed rocks.

The value of the Kelsh operation is especially obvious in areas difficult for normal field-party operations such as Libya. Structural contour maps can be prepared on anomalies already indicated by previous stage photogeology or located by air or ground reconnaissance. Structural contouring can also be applied to larger low-dip areas as a method of discovering low relief structures not obvious by previous photogeology or reconnaissance field work.

Conclusions: Most of the photogeologic evaluation in Libya is now in Stage II, "reconnaissance evaluation," as described above. Photographs suitable for Stage III, "detailed evaluation," cover only a small portion of the country; but, as a logical next step, it is expected that larger-scale photography will be obtained to allow detailed photogeologic work. The ultimate application of photogeology will be utilization of high-order photogrammetric plotters, such as the Kelsh, to provide Stage IV, "quantitative geologic," data.

The writer is indebted to R. L. Anderson, chief geologist, and Dr. Don B. Gould, administrative geologist, The Geophoto Group, for valuable assistance in the preparation of this article.

END

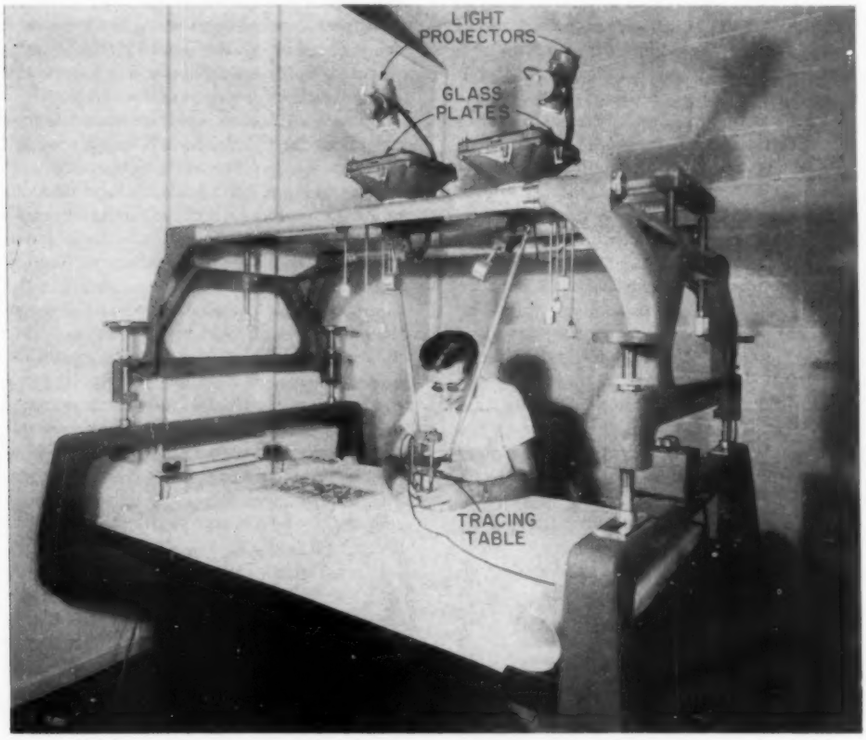


Fig. 5 The Kelsh plotter (photo, courtesy Jack Ammann Photogrammetric Engineers).

Oil discoveries in the Amazon basin

Discovery of oil in Peru's Montaña—lying east of the great Andes Mountains—has revived interest where hopes had begun to fade. The Montana is South America's largest concession area, and any encouragement in so potential a territory is important.

by Dr. J. E. Rassmuss*

THE Peruvian Amazon basin comprises about half of the country, or some 600,000 square kilometers (150 million acres). It also contains the largest concession area in South America—amounting to 13,562,892 hectares as of July 1957, or about 33½ million acres, having decreased about 2.5 million acres since last year. Concessions are held by 16 companies, including five majors, viz., Texas, International (Standard of New Jersey), Richmond (Standard of California), Gulf, and Mobil Oil Co. Skiles Oil Corp., of Mt. Carmel, Ill., was the last to acquire about 500,000 acres last year.

The discovery of oil in March 1957 in the Maquia well, near the Ucayali River, by the national El Oriente Co.—associated with a syndicate of three major German oil companies, viz., Deutsche Erdoel, Wintershall, and Elwerath—recently has focused attention on the oil prospects of this vast region. Here the Ganso Azul field, discovered almost 20 years ago, so far has been the only producer.

The Maquia No. 1 well, about 4 miles east of the Ucayali River, is located on a southeast-northwest striking structure in the Tertiary Red Beds, parallel to the anticline of the Contamana Mountains which rise to the northeast. Three wildcats have been drilled on this structure (see accompanying map). The first well, Cashiboya No. 1, mostly to the southeast, became stuck; then a second hole was drilled, Cashiboya No. 2, to a depth of 4,579 ft, and slight shows were found in the sugar sandstone—the uppermost Cretaceous member. Farther up the Cashiboya creek, oil seepages are located on a fault line to the Contamana Mountains. The second well, Inuya No. 1, six miles northwest, reached a depth of 6,022 ft, but proved dry. The third well—located at Maquia, about 14 miles northwest and 4 miles east of the village of Contamana—was completed in March 1957 to 5,323 ft, but found the Agua Caliente sandstone of lower Cretaceous age, which encloses the oil sands in the Ganso Azul field dry. The Cretaceous formation—which is the only oil-bearing one in the Peruvian Amazon basin known so far—in the Ucayali region is composed by the Agua Caliente sandstone at the bottom, which corresponds to the lower Cretaceous large transgression observed from Ecuador through Peru as far as Bolivia, following the orogenic movements of the Nevadian stage. The Agua Caliente formation—built up mainly by massive sandstones with an intercalation of dark shales in Ganso Azul containing Aptian fossils—is overlain by the Chonta formation of limestones and limy shales which, in Ganso Azul, contain a rich fauna of Coniacian age. The uppermost member of the Cretaceous formation is the sugar sandstone, or Vivian, which in Ganso Azul is about 500 ft thick. The Maquia well was plugged back, and tested again according to the electric log at a depth from 2,139 to 2,162 ft—where it yielded, on test, about 500 b/d of 38 API crude through a ¼-in. choke. Bottom-hole pressure was about 190 psi.

Some 1640 ft northwest of the discovery well, Maquia No. 2 was completed at the end of June to a depth of 3,360 ft. It also struck oil in the sugar sandstone at a depth of 2,132 ft—yielding, reportedly, 600 b/d of 38 API crude. The company intends to drill three ofset wells—one about 1,968 ft to the northwest, and one on each flank—to test the extension of the pool. If the results warrant, a pipeline will be laid to the nearby Ucayali River for shipping the crude.

Economically, this field is located favorably because the crude can be shipped by river to the government's new refinery at Iquitos to supply the growing local demand of Peru's Montana which, so far, has scarcely reached 1,000 b/d. It can also be shipped farther, to the 5,000 b/d refinery at Manaos—put in operation last year—which is the final point for economic river transportation. Ganzo Azul field so far has been able to supply only 1,500 b/d to the Manaos refinery because it also has to supply some 800 b/d to the national Iquitos refinery, and the reduced extension of the field does not seem to permit an increase in rational production in excess of 2,500 b/d to 3,000 b/d. The urgent need for crude of the Manaos refinery, therefore, would offer a convenient market for some 3,000 b/d additional crude.

From a geological standpoint, the Maquia structure is separated by a syncline in the Red Beds from the Contamana Mountains to the northeast. The Contamana Mountains constitute a northwest-southeast striking anticline, subdivided into seven minor folds, with a steep flank to the southwest to the

* Lima, Peru.

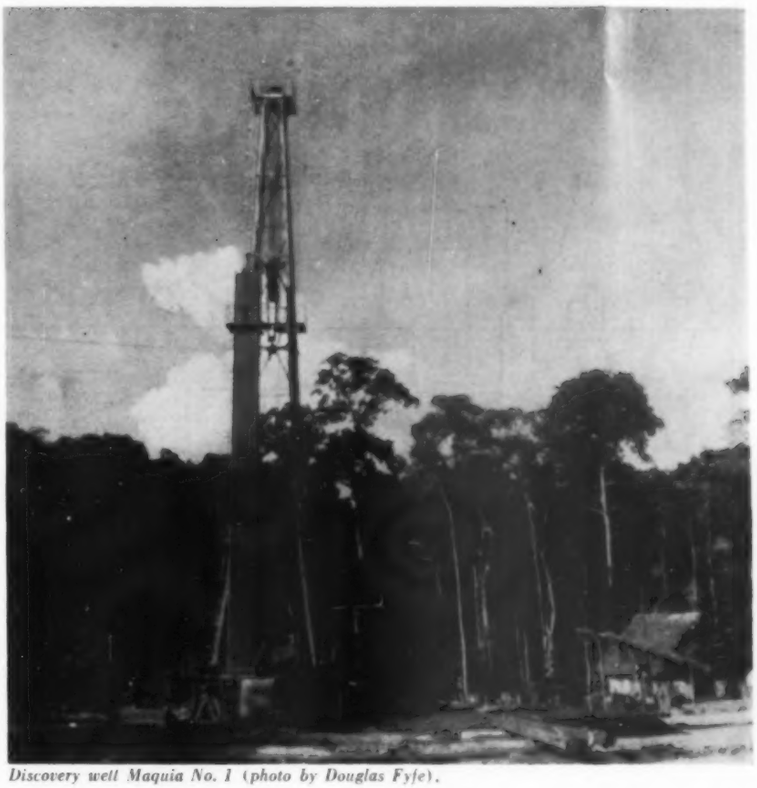
Ucayali basin—with an inclination of only 10° to 15° northeast. This structural picture of asymmetrical folds to the southwest —which is similarly observed farther east in the Sierra de Moa in Brazil—is in sharp contrast to the northeasterly overturning and overthrusting of the eastern Cordillera in the west, in the Huallaga region; apparently it is caused by the underground uplift of the Brazilian shield. This is indicated also by the decreasing thickness of Cretaceous deposits to the northeast, to the Contamana Mountains, and it was proved by the wildcat of the same Oriente Co., at Canchahuayo, on the northern crest of the Contamana anticline, which struck basement syenite-diorite at a depth of 2,600 ft.

To the northwest, in the Ucayali basin—about 25 miles distant, and more or less in the same line as the Maquia structure—the Santa Clara dome is uplifting from the basin. The Santa Clara dome constitutes the highest structural elevation in the basin because, at its center, the uppermost member of the lower Cretaceous Agua Caliente sandstone (the more shaley Huya member) is outcropping at the surface. However, a wildcat of Ganso Azul drilled in 1956 encountered, below the dry lower Cretaceous Agua Caliente formation, Jurassic sandstones of the Chapiza formation; it was abandoned dry at 3,870 ft. The company has considered no further drilling. About 10 years ago, the government's Empresa spudded a wildcat on the Santa Clara dome which had to be abandoned at a depth of about 1,100 ft because of technical difficulties.

Some 100 miles south of the Maquia discovery, the Ganso Azul field, is located. In Ganso Azul, 20 wells have been drilled so far—16 of them producers. Drilling on the Chonta island—the second structure of the field—has been unsuccessful. The well was abandoned in 1955 at 2,197 ft in the Permian limestone. In the Ganso Azul dome, granite was struck at 5,129 ft, when discovery well No. 1 was deepened.

Production of Ganso Azul field in 1956 amounted to 402,807 bbl (1,104 b/d). This has been increased with improved shipping facilities, i.e., completion of the 48-mile pipeline to Pucallpa on the Ucayali River and the acquisition of new barges and more efficient tugs. Highest production so far has been 92,496 bbl in April 1957, or some 3,000 b/d. In May 1957, production was 65,126 bbl: and in June, 58,006 bbl. By decree of the government of June 27, 1957, minimum production of Ganso Azul—which is subject to the old law, No. P251.—has been set at 75,000 metric tons, or about 550,000 bbl yearly. A new holding company for Ganso Azul was formed in 1956, viz., Transportes Amazonicos. It operates seven tugs for local transportation, as well as the "Queen of the Amazon," a new 1,800-hp tugboat, for transport to Manaos. This tugboat pushes four barges, each with a capacity of 12,000 bbl. The trip downstream to Manaos takes 9 to 10 days, and the return trip upstream to Pucallpa about 14 days.

Twelve wildcats have been drilled in Peru's Montaña of which only the last Maquia well struck oil. Seven of them have been drilled in the Ucayali region—one at Chonta, near the Ganso Azul dome; three on the Maquia structure (not counting the first hole, which stuck); one at Canchahuayo on the Contamana anticline, by Oriente; and two on the Santa Clara dome, by the government and Ganzo Azul Co.



Discovery well Maquia No. 1 (photo by Douglas Fyfe).

El Oriente Co. drilled two wildcats on the Pisqui anticline—well exposed on the surface in the Tertiary Red Beds—about 34 miles upstream on the Pisqui River from its confluence with the Ucayali. The first well, Coninca No. 1, reached 4,650 ft—just entering, below the lower limit of the Red Beds, the upper Cretaceous. The second well, Coninca No. 2—to a total depth of 9,106 ft—at 4,360 ft passed the lower limit of the Tertiary Red Beds, and then about 3,500 ft of Cretaceous. It found, in the Agua Caliente sandstone at about 7,700 ft, small shows of oil and gas. Below that, it struck, to 8,500 ft limestone—probably of Liassic age—and then hard sandstone and shales; at the bottom, it encountered metamorphized schists. It was abandoned dry.

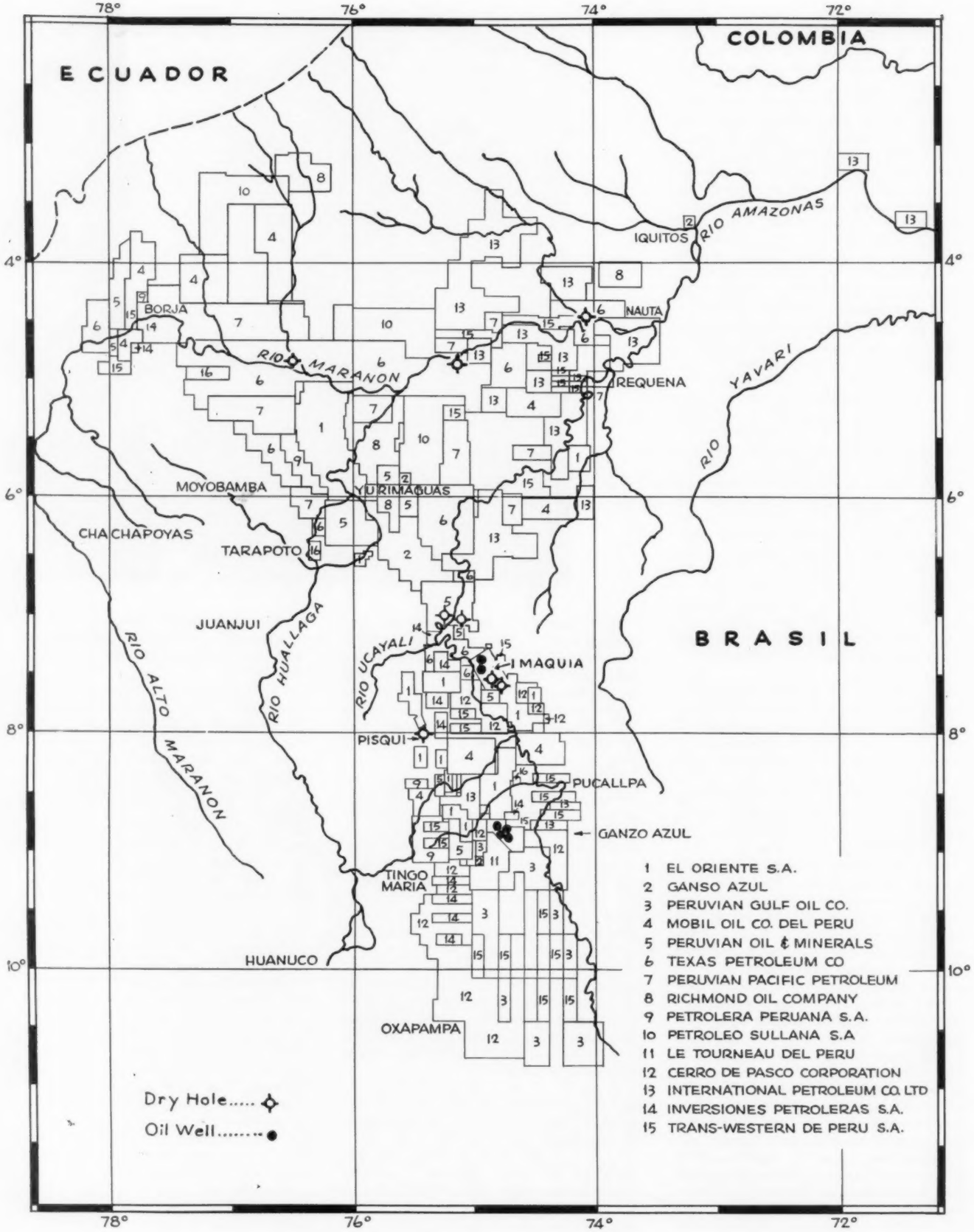
Texas Petroleum Co. in the Marañon basin drilled three wildcats—one on the upper Marañon, near Barranca; the second, on the middle Marañon, below the confluence with the Huallaga River; and the third, on the lower Marañon, near the mouth of the Tigre River. The first two almost reached 10,000 ft. The third is the deepest well drilled so far in the Peruvian Amazon basin—with a total depth of 11,537 ft, at a cost of $350,000 to $400,000. All remained dry.

With respect to the results of the few wildcats drilled in the Peruvian Amazon basin, some problems may be summarized as follows:

In the Ucayali basin, two discoveries have been made—the Ganso Azul field and, some 100 miles north, the Maquia discovery which may prove a similar field. But thus far no large, deep sedimentary basin has been proved in the Montaña, and several of the few wildcats have struck basement at moderate depth, if the thickness of the Tertiary continental deposits on top is considered. In the Ganso Azul dome—where the Cretaceous is outcropping—granite was struck at 5,129 ft. In the Coninca wildcat, on the Pisqui anticline—which is located on a southeast-northwest structural line from Ganso Azul over Pisqui, to the Cushabatay anticline in the Huallaga region —metamorphized schists of the basement were encountered, at 9,100 ft, which have been considered as Paleozoic. In the Canchahuayo well, near Orellana on the Ucayali River—about 20 miles north of Contamana—syenite-diorite of the basement was struck at 2,600 ft. In Cashiboya 2, Paleozoic—possibly Silurian—was encountered at the final depth of some 4,600 ft. In the third Marañon well, by Texas Petroleum Co., near the mouth of the Tigre River and some 75 miles southwest of Iquitos, Paleozoic of the basement was reached at 9,557 ft.

In the Marañon basin, the Texaco wells proved Tertiary continental deposits of great thickness. In the first Marañon well at San Lorenzo, near Barranca—which reached 9,787 ft—only continental Tertiary, and possibly Cretaceous, beds were reported

Fig. 1 Peruvian Drilling—Montaña



to have been traversed. The second Marañon well—which had to be abandoned at 9,196 ft because of a river flood—apparently found a similar sequence.

The results of these wells indicate a thick sedimentation, mostly of Tertiary continental deposits, but slight development of marine beds which might be considered a source for the generation of oil.

In Ganso Azul, the highly saturated, course oil sands are found in the Agua Caliente formation, underlain by the impermeable "ash bed." An intercalation of some 500 ft of dark shales has been considered as a source bed. The unconformably underlying marine, bioherme, fusuliniferous Permian limestones, more than 3,000 ft thick, had no oil shows. Below, some hard sandstones were found—possibly of Mississippian age—which may correspond to those encountered at the Pisqui well above the metamorphic schists.

Theoretically, as a most probable source bed in the Montaña, might be considered the bioherme Permian limestones which are known in a vast extension in the Peruvian Amazon basin from Madre de Dios in the south to Ecuador in the north; but no proof thus far has been established that they are oil-bearing.

The lower Jurassic limestones, exposed in the Huallaga region—which contain bituminous intercalations and correspond to the Santiago formation in Ecuador—also might be regarded as a proper source bed. The numerous salt extrusions—exposed on faults and overthrusts and attributed to Oxfordian age—generally are associated with oil seepages.

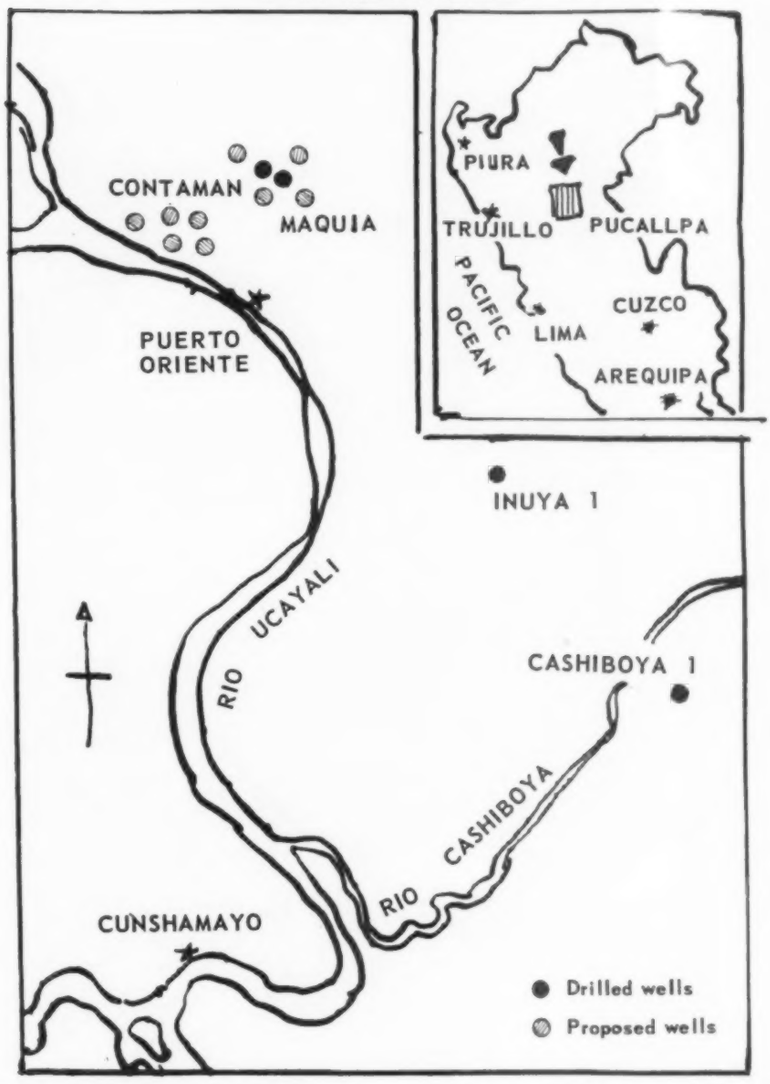
Ganso Azul's oil sands in the lower Cretaceous generally have been considered as primary, but the Maquia oil in the upper Cretaceous sugar sandstone certainly is secondary; and no oil has been found in the lower Cretaceous Agua Caliente. Origin of the Maquia oil has not as yet been disclosed.

The Devonian shales, which constitute such a prominent source bed in Bolivia, are not known in Peru's Montaña.

Exploration in the Montaña is progressing slowly because of the dense jungle, accessible only by rivers, and because of its vast extension. No drilling besides Maquia has been proposed for the near future. Cerro de Pasco Oil Corp.—which conducts geological surveys in the southern Ucayali region, where the Iscozazin structure has been considered promising, and where the finding of oil would be of particular importance for supplying the mining operations of the parent company in the Cordillera to the west—has announced it will start drilling in 1959.

Richmond Oil Co. recently relinquished 13 concessions totaling some 550,000 hectares, or more than 1.3 million acres—mostly in the region of Rio Pastaza in the upper Marañon basin—and some others south of the location of the third Texaco wildcat. Peruvian Gulf Oil Co. has abandoned six concessions totaling about 700,000 acres in the southern Ucayali basin.

THE MAQUIA WELLS

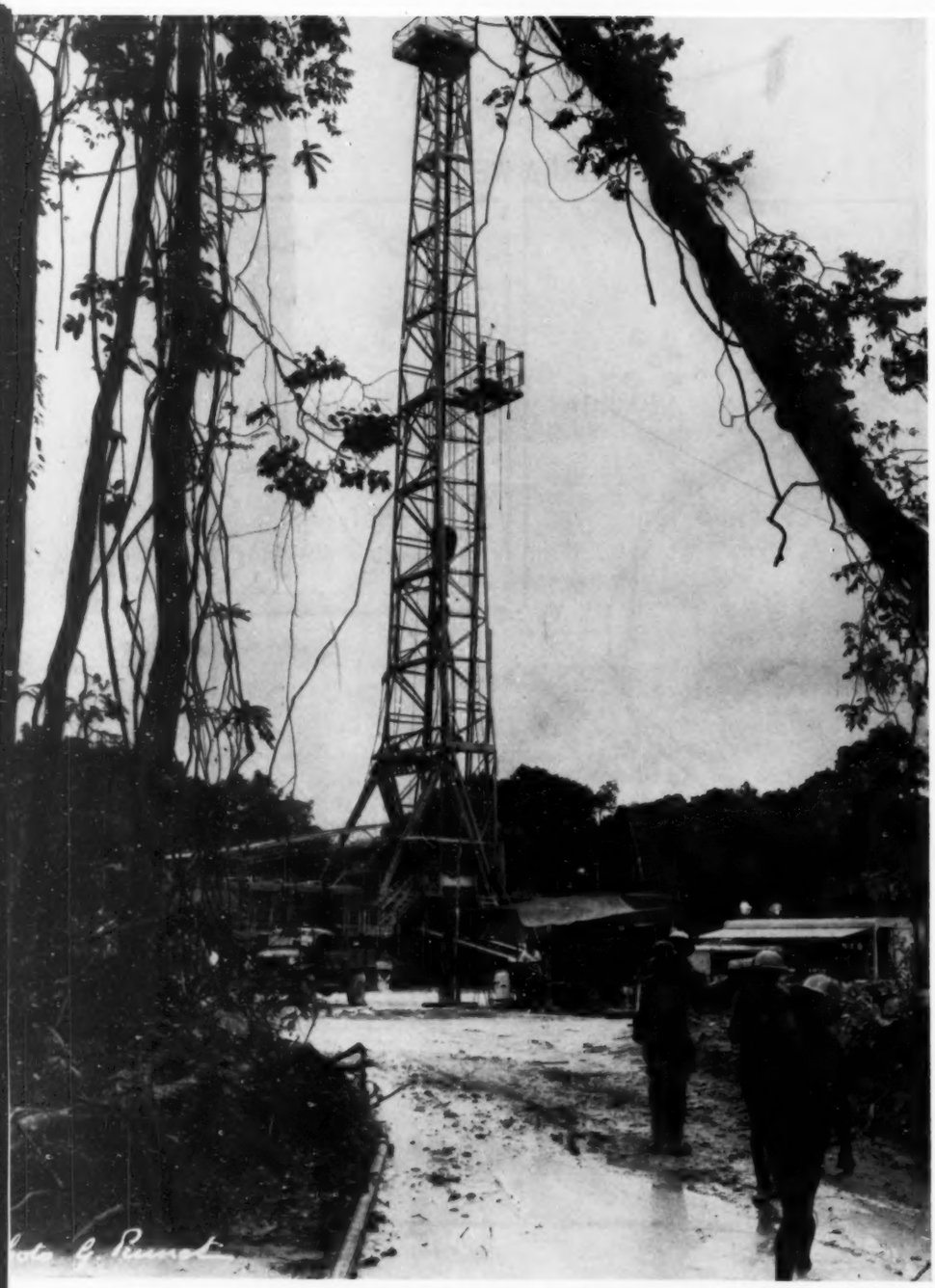


The surprising discovery of oil in Maquia conducted by Douglas Fyfe, pioneer oil geologist in Peru's Montaña, and one of the discoverers of Ganso Azul, and due to the perserverance of the national El Oriente Co. (whose faith in the Montaña has not been discouraged by previous failures), and the enterprising activity of the German companies—is of the greatest importance. It will speed exploration in the Amazon basin—the development of which is of primary importance to Peru, where no major new reserves have been discovered for a long time.

Of similar importance to Brazil has been the discovery of oil at Nova Olinda in the Amazon basin southeast of Manaos. The first well, Nova Olinda No. 1, struck oil at 8,970 ft in sandstones believed to be Devonian—for an oil-bearing thickness of 60 ft; but porosity and permeability were low. Initial flow of the 42 API oil was reported as 100 b/d to 200 b/d. As bottom-hole pressure was low—about 1,600 psi—pumping was resorted to; but later the well was abandoned as non-commercial. However, drilling recently was resumed for testing lower levels and for reaching basement. About 500 meters distant, Nova Olinda No. 2 struck oil in a deeper horizon, at 9,030 ft; here permeability and pressure have been reported as higher. Initial test indicated 500 b/d of 44 API crude; sand thickness, about 20 ft. About 2.5 miles southwest of No. 2, No. 3 has been drilled to 11,000 ft for stratigraphic purposes and for determining the position of the intercalated diabase sills. Two more drill sites have been located farther southwest.

As the seismic surveys have indicated the possibility of a larger sedimentary basin and presence of large flat anticlines, this region is considered the most promising prospect in Brazil.

In the lower Amazon, on Marajó island—at the mouth of the river—a thick sedimentary sequence has been proved by seismic surveys in a tectonical graben by the drilling of three wells. Two of them, to almost 14,000 ft (4,027 and 4,040 meters), proved dry, and drilling has been abandoned. END



SPAEF Emsco rig is shown probing the Bilarge structure in Gabon's coastal sedimentary basin.

THE GABON... A NEW OIL PROVINCE

by Maurice Moyal

FOR some time the 959,256-square-mile coastal sedimentary basin of Gabon, in French Equatorial Africa, has been regarded favorably for oil prospects. As early as 1926 an advance party was sent by Standard Oil Co. to explore its possibilities. Apparently the company resisted the huge costs which would have been required to explore and develop this difficult mangrove and primeval forest country, whose only means of access are rivers.

In 1932 the Société des Pétroles de l'Afrique Equatoriale Francaise (known as SPAEF), owned 57.8% by the French government's oil agency Bureau de Réchèrches de Pétrole (BRP)—began taking a long-range view of this forbidding and largely uninhabited country, plagued by one of the world's most trying climates—with temperatures as high as 120° F. not uncommon.

Costly Development Program: The output of three relatively minor pools at Pointe-Clairette, Ozouri, and Port-Gantil thus far has provided the only concrete payoff for a $50 million 35-year development program extending all the way from topographical and geological mapping to marine seismic work and extensive drilling. SPAEF expects to obtain 6,000 b/d from its properties this year, rising by next year to 10,000 b/d.

Oddly enough, the operator decided to investigate first the most easterly section of the Gabon basin, in the region around Azingo Lake and downstream from the town of Lambarené, where Dr. Schweitzer is located—some 150 miles from the Atlantic seaboard, in the central Congo territory.

Costly experience proved this section far less capable of easy reconnaissance and less promising than had been believed originally. The deep sedimentary formations were badly cut up by extensive faulting, and the oil shows occasionally encountered led to no commercial discovery. Here, many thousands of feet were drilled unsuccessfully. Following a dozen dry holes, the unsuccessful No. 3bis NG test induced the operator to abandon the area as hopeless.

SPAEF then shifted its effort to the western end of the Lambarené-Chinchoua crystalline trend—probing the Chinchoua cliff eight miles southeast of the Atlantic harbor of Libreville. Further work has been suspended here because of an almost total lack of success.

As a last resort, the operator decided to concentrate on the coastal region farther south—which, in fact, should have had his first attention. This 30-million-acre concession, which has been held ever since 1949, roughly is centered around Port-Gentil. After less than two years of probing, the section in the vicinity of this At'antic port—situated just south of the equator—has begun to pay.

Definition of General Trends: A systematic 20-month gravimetric campaign was conducted to define the general structural trends in this southern section of the Gabon sedimentary basin—embracing essentially the island-strewn delta of the Ogooué River and the swampy mangrove country to the south. Methodical geophysical work, plus

a series of medium-depth holes for geological information, established that the subsurface apparently bears little relation to the surface. Under the uniform monoclinal surface, the deeper sections had been affected greatly by extensive faulting. Results showed that whatever production existed in these structures would be much harder to tap than had been believed originally.

All over the coastal basin, exploration located massive salt deposits during drilling. Thus, No. 1 PG, on the outskirts of Port-Gentil, reached the Aptian at around 11,000 ft; and No. 2 PG, at 3,600 ft. At Mondorove, 15 miles southeast of Port-Gentil, No. 1 MD traversed 3,300 ft of salt deposits; but was abandoned as a dry hole at 8,712 ft. No. 1 DZ in the northeast corner (also unsuccessful), 60 miles northeast of Port-Gentil, pinpointed salt deposits at 2,500 ft.

All these tests established favorable reservoir conditions and promising oil shows —especially No. 1 MD and No. 2 PG. Drilling on top of the Port-Gentil salt dome permitted testing its flank by seismic refraction. No. 4 PG encountered oil-impregnated layers. However, production tests ran into difficulty.

First Commercial Strike: No. 5 PG, spudded in July of 1955 with a newly purchased Ideco-H 25 light-duty rig, encountered the same oil-bearing horizons. A drill-stem test resulted in a flow of oil from the interval 4,174 ft to 4,207 ft. On choke, the discovery for 10 days flowed an anhydrous crude, with a 0.930 density, at the rate of 8 cu m per day (about 50 b/d). Storage tanks on the spot will receive the 40 b/d production from this minor field discovery.

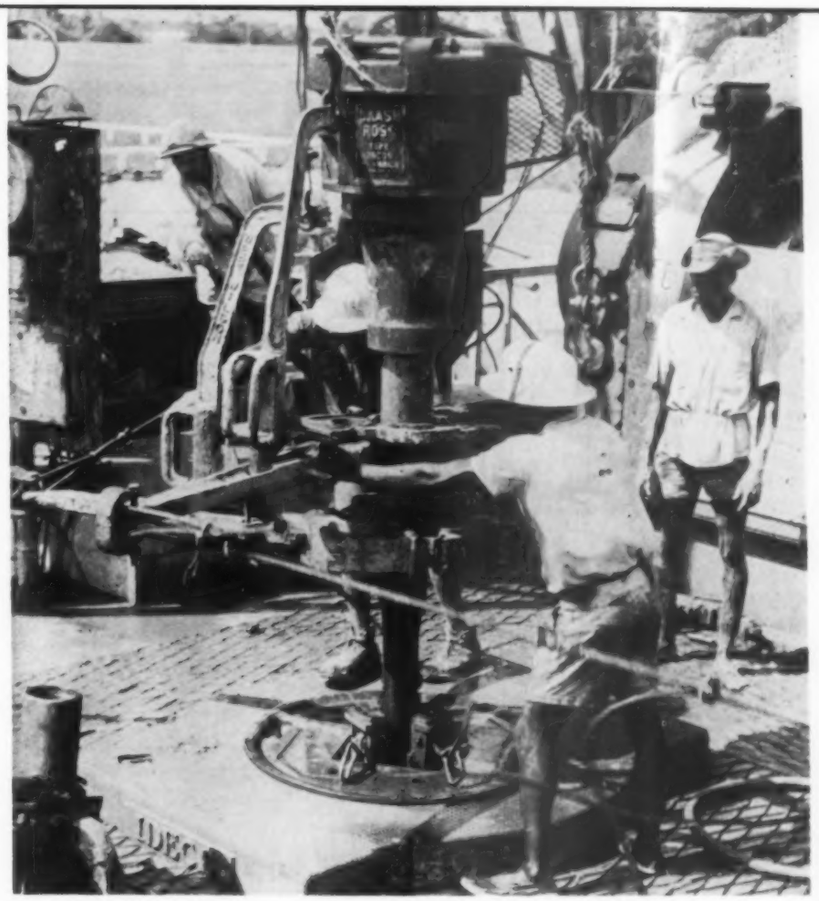
As the light and medium duty rigs permitted drilling only the top of the local salt domes, this first indication of commercial oil encouraged SPAEF to purchase a new heavy-duty Ideco Super 7-1 rig to probe the flank reservoirs. Ice-Age Wilson and Unit rigs were sold to SEREP CA.

It was decided to probe a salt dome, spotted on river seismic work at Yombé, No. 1 Yombè, 1.5 miles east of 1 PG, penetrated the Tertiary; tested about 10 bbl of crude from a Paleocene limestone reservoir at about 2,600 ft; went 300 ft through the Cretaceous, where it traversed more than 3,300 ft of salt deposits. It was taken down to 6,150 ft for seismic refraction work, but proved undecisive with regard to the flanks of the dome.

No. 1 N'Goboué (also on top of a seismic structure), 15 miles east of No. 1 Yombè, logged some oil shows from the Paleocene at about 1,600 ft. It was abandoned as dry at 7,100 ft in the impermeable Senonian.

Following promising oil shows by No. 1 MD, from limestone and dolomitic layers of Paleocene age at around 1,600 ft, No. 2 MD further tested these shallow potential pays. It flowed about 10 bbl of a completely oxidized crude, containing 30% water. However, this Mondorove structure, 15 miles southeast of Port-Gentil, will be tested further in the near future.

Ozouri Field: In February of 1956 SPAEF discovered the Ozouri pool—far more promising than the minor find at Port-Gentil. Twenty miles southeast of Port-Gentil, the field is situated on the flattish top of an elongated salt dome—with a southwest-northeast axis—which seismic work has shown to extend at least 12.5 miles at a depth around 3,300 ft. The field proper extends along the eastern shore of the Animba lagoon; extends under its floor—and takes in a little tongue of land which separates the lagoon from the Atlantic.



Drilling operations in progress by SPAEF in Gabon: Equipment is American (note Ideco rig) and personnel American-trained.

Underlying uniformly marly post-Miocene, upper and lower Miocene, and sometimes clayey Oligocene sections, the pay here is of Eocene age. The silicified reservoir varies in thickness from 46 ft in No. 1 OZ to 287 ft in No 6 OZ. Its production is from permeable fractures lying generally at the interval between 2,059 ft and 2,277 ft—although pay has been found as far down as 3,696 ft in the deepest, westernmost section of the pool.

The as yet undefined areal extent of the pool, and lack of information about pressures which may develop, preclude evaluation of the real caliber of the strike and of the best exploitation methods. Although SPAEF is not crystal-gazing, some unofficial estimates put local reserves at 30 to 37 million barrels. And its location close to the coast makes this field a sound business proposition.

To evaluate the field and establish its boundaries, both development and extension drilling are being pushed. As the lagoonward extension lies beneath 3 ft to 30 ft of water, with some 3,300 ft of overlying sections, inshore drilling poses no special problems.

Although makeshift, a barge-mounted platform driven by a Cummins engine could accommodate a heavier rig, capable of drilling to 6,500 ft, were extension of the water-covered section to require this.

Because of the shallow depth, a light-duty Ideco-H 25 rig was adequate for bringing in the No. 1 OZ discovery. An Ideco-H 40 medium-duty rig is being used, *inter alia*, for pool development. Because of an active water drive, commercial production should present no difficulties—at least in the initial stages of the pool's life. Favorable permeability has obviated fracture treatment. Because of the fractured silicified marls of the reservoir, all wells have been completed as average holes.

Of the 12 wells completed to date, No. 2 OZ proved a dry hole; whereas No. 3, 6, and 12 OZ have encountered salt water. No. 1, 4, 5, 7, 8, 10 and 11 OZ, on the average, produce 63 b/d—although, in the case of No. 4 OZ, production has been as low as 31 b/d, and even 15 b/d, through perforations. The high density, 0.930, of the local crude seems to account for these variations.

The Ozouri pool yields heavy crude, of high viscosity. With a negligible amount of paraffin, it is high in asphalt. In some respects, it resembles Venezuela's heavy Lagunillas oil—although it contains smaller amounts of asphalt and sulfur, with a larger gasoline yield.

Table 1 gives the properties of the Ozouri and Pointe-Clairette crudes.

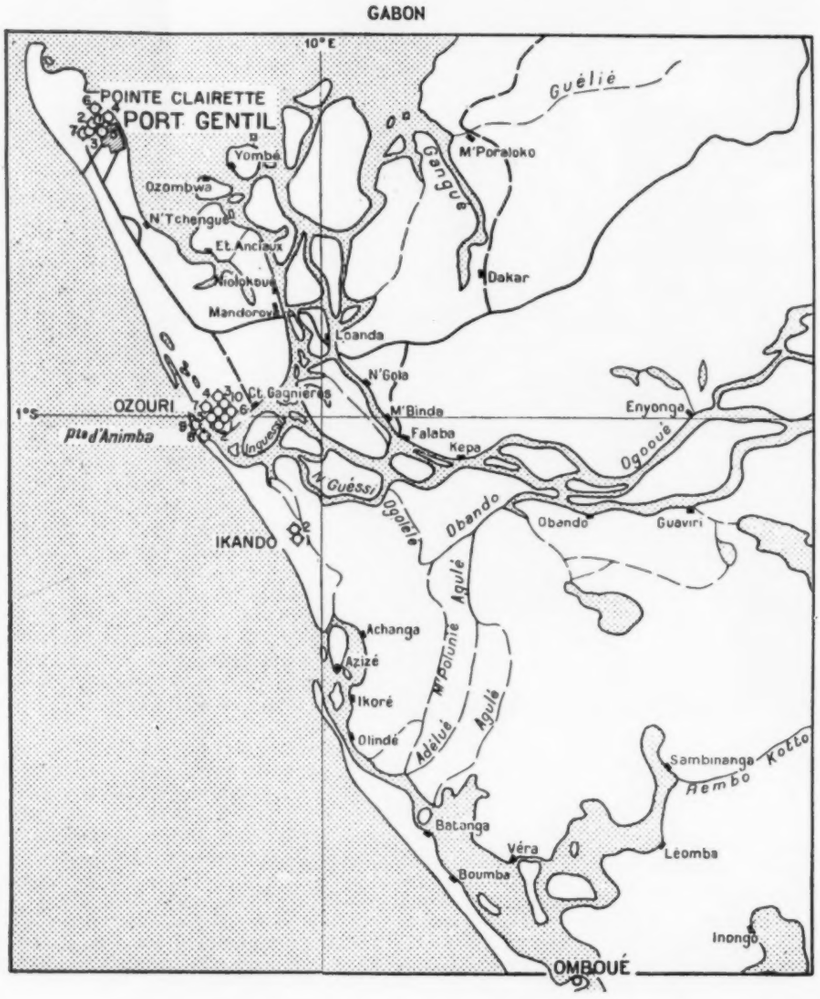


TABLE I

PROPERTIES OF OZOURI AND POINTE-CLAIRETTE CRUDES

	Ozouri	*Pointe-Clairette*
Density	0.930	0.880
Gravity, API	20.6	29.3
Viscosity (Engler) at 35 C	53.4	3.14
Pount Point C	-21	-40
Flash Point, C	38	18
Water, %	0.55	0.10
Sulfur, %	2.20	0.72
Sediment, %	0.03	Nil
Asphalt, %	4.25	1.0
Paraffin, %	0.60	2.0

Once the possibility of continuous production had been reasonably established, the operator provided a floating dock to load 350-ton sea-going barges to transport the local crude to the tank farm constructed at Cap Lopez, of slave hunters' fame. A 10-mile 8⅝-in. pipeline connects the Pointe-Clairette pool with storage facilities. Present storage-tank capacity is 225,000 bbl (soon to be doubled), capable of taking a month's production from both sources—expected by next year to reach 15,000 b/d.

An initial shipment of 375,000 bbl already has reached French refineries in the le Havre area. A similar shipment is on its way to Shell, Caltex, Mobil Oil, and BP processing units in metropolitan France. The crude currently is being moved, along 1-mile sea-loading lines, onto small tankers —as is done in the Persian Gulf. To fill in part of the whalers' lagoon will take 200,000 cubic yards of sand. This will enable construction of a deep-water dock, capable of accommodating larger 15,000-ton tankers, for more economical crude transportation.

Because of wide differences in properties, each type of crude has required erection of separate tankage. For the high viscosity Ozouri type, heating facilities had to be built to speed pumping of the oil onto tankers at the rate of 50,000 bbl per hour.

Most Significant Strike in the Gabon: The Pointe-Clairette paraffin-base crude is of average viscosity and density. In a few respects, it may be compared with the better-grade oils from Kuwait, and from Venezuela's Mara.

Less than a mile to the northwest of Port-Gentil, and lying on a 2 to 3-mile-wide strip of land which juts out 20 miles into the Atlantic, the Pointe-Clairette structure is part of a vast anticline which overlies a 6,600-ft-deep subsurface salt dome. Two main pays—capped by upper and lower Miocene—have proved capable of commercial exploitation:

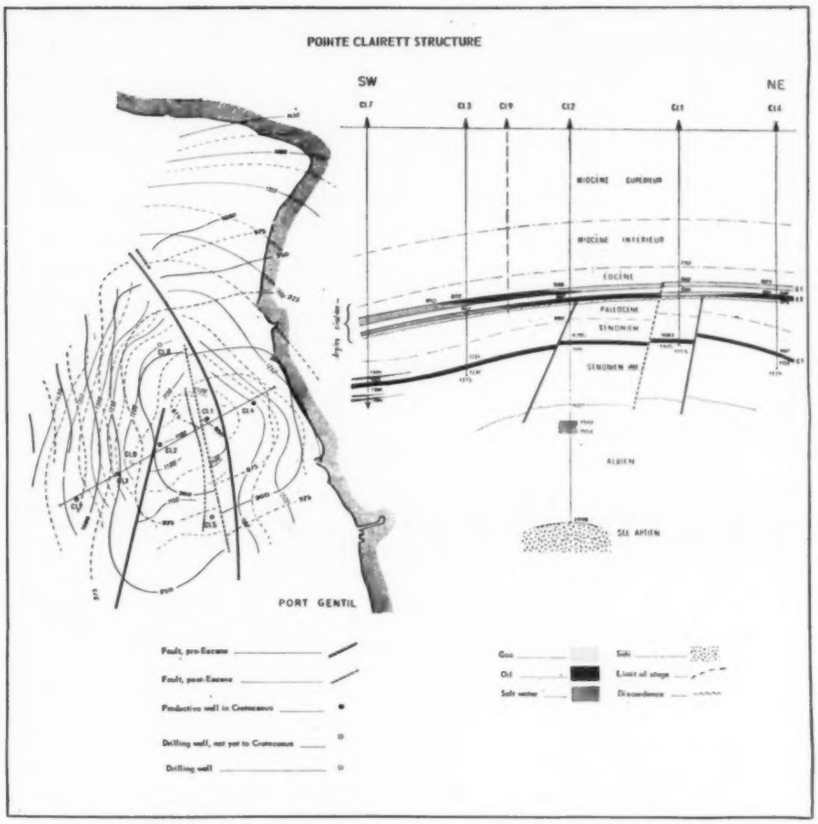
1. The silicified marls, of Eocene age, somewhat akin to the Ozouri pay, are made up of two zones separated by a 90-ft interval. At about 2,800 ft, the first is topped by an important gas cap, whereas the thinner one is associated with a smaller gas cap. The shallower reservoir has been yielding 12.5 b/d—the deeper one 31.5 b/d—on an average for each of the five completions producing from the Eocene. The presence of swelling marls has required the use of mud with a density of 1.40, with a minimum free-water content. Formation tests, thus, have been a feature.

2. The deeper pay sands—identified as Upper Cretaceous-Senonian—have been yielding between 113.5 b/d and 945 b/d of highgrade crude for each of the 11 wells from this and/or both pays. Practice has been to put as many wells as possible on duel completion. The sands here are irregular, relatively thin — only about 23 ft thick. The looseness of the sands makes imperative completion through perforations in all 18 holes—only two of which have failed to find production. Producers have been put on ⅛-in. and ⅛-in. chokes.

Worthy of note is the existence at No. 2 CL of a good additional dolomite reservoir—in all probability formed in the Oligocene by a fault. Most encouragingly, No. 7 CL has revealed no less than three additional pays in the upper and lower Senonian —running toward the western flank of the structure. Here, again, pending more complete data on the areal extent of the field, the structural variations possibly existing between wells, and the nature of the reservoir drive, the operator cautiously has refrained from venturing any guess with respect to reserves. Unconfirmed estimates put these at 40 to 45 million barrels. These unofficial estimates are susceptible of considerable upward revision should the field extend in a westerly direction, as No. 7 CL would seem to indicate.

Considerable further probing will be required to establish the definite boundaries of the new productive area, the best exploitation methods, and a proper evaluation of local reserves. The operator will bring in five more rigs and, by the end of 1957, these should help tell the story.

Impact of Discoveries: Pointe-Clairette and Ozouri have given a powerful shot in the arm to the exploratory work under way. Number of rigs in the area soon will be increased sixfold. The magnitude of activity is reflected better by the figures on exploration crews. During 1956, SPAEF totaled 80 crew-weeks of land-and-river seismic work, 52 crew-weeks of gravimetric exploration, 7 crew-weeks of airborne magnetometer



work and 2 crew-weeks of marine seismic exploration. This effort—which is being stepped up considerably—can be evaluated only in the light of the difficulties of access to the country—pelting tropical rains permit work only seven or eight months during the year; where disease-breeding swamps make imperative crew rotation frequently. Seismic crews often have had to grope their way on foot through water-covered mangrove, without the shelter even of the crudest native dugout.

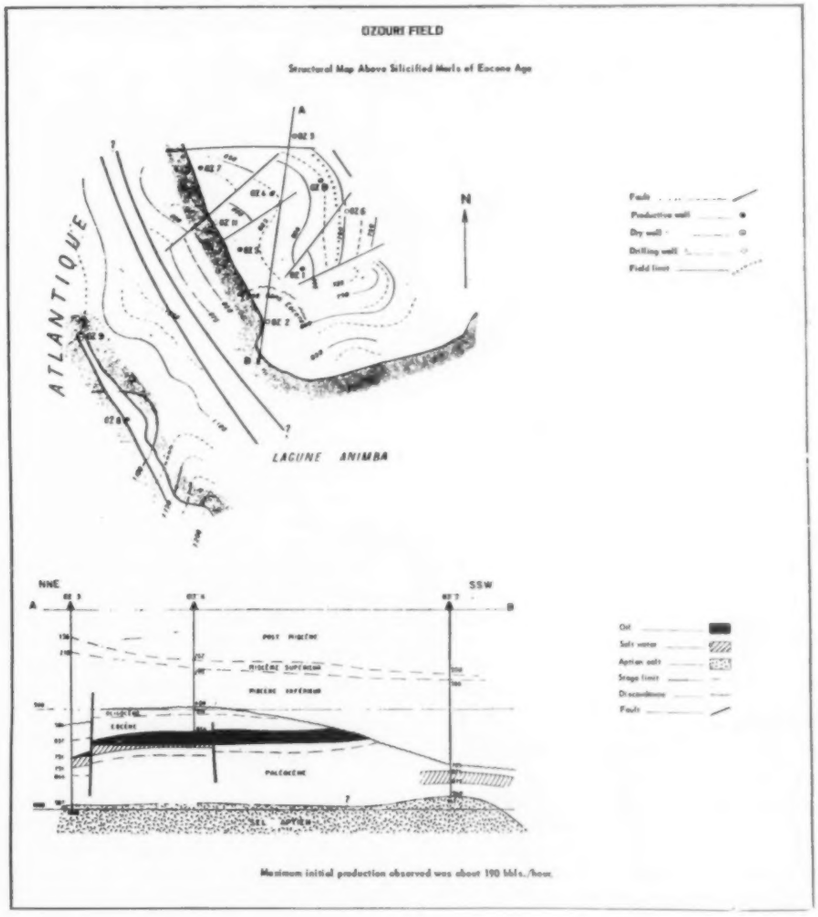
All movement through the Gabon, with the exception of air or water, requires paths to be bulldozed through the forest or jungle. Light planes are used to speed up survey work. SPAEF has a fleet of vessels extending from 10-ton launches to sea-going ships and tugs. For its 500 European and 2,000 African personnel, it has built completely integrated communities near Port-Gentil, site of its headquarters —with homes, schools, hospitals, shops, and the other amenities of civilization.

Development Program: Thanks to intensive spade work, the operator not only has defined the main structural trends, but has pinpointed more than 100 salt domes which will take years of drilling. In some areas, however, the results of seismic reflection have been spotty—even at shallow depths. Neither has seismic refraction proved conclusive.

In the delta of the Ogooué, detailed geophysical, gravimetric, and magnetometer studies—followed by seismic refraction—have warranted staking of a number of likely drillling locations, such as those at M'Bega, Mondorové, Animba, and Tchengué. Since April 1957, a key well has been probing the latter location—roughly midway between Pointe-Clairette and Ozouri. Another key test currently is under way on the promising M'Bilapé structure, 31 miles east of Port-Gentil—both with as yet unreported results.

In the deep south section of the Ogooué delta, No. 1 IK and No. 2 IK on the Ikando structure have confirmed interest in the Eocene and revealed possibilities of the deeper Cenomanian and Turonian in the country lying between Ozouri and the Fernan Vas lagoon, 50 miles south of the pool. A deep test shortly is to be drilled to the southernmost section, bordering on the central Congo territory.

The operator expects the promising structures in the Ogooué delta to contain, at best, pools of the Pointe-Clairette and Ozouri type—characterized by modest and irregular reservoirs of limited area. In the outlying sections, possible finds would be even more modest because they ring the flanks of smaller salt domes—a feature which makes drilling costlier and slower. Nevertheless, seismic work has established the existence of several large anticlines, with extensive drainage areas, and good cover and reservoir rocks favorable to the accumulation of oil. Of course, the initial wealth of the source rocks is still on unknown quantity. END



Pipeline projects in West Germany

by A. M. Stahmer

Up to now the West German petroleum industry only concentrated on a great number of small crude-oil pipelines which linked the oil fields or refineries with railway stations or ports and some natural-gas lines of medium size. At the end of 1956, total length of the crude pipelines—of which only seven have a length of more than 10 miles—was 248 miles; while the natural-gas lines totaled 186.4 miles. Besides, 63.9 miles of finished product lines should be mentioned. With few exceptions, the diameter of all these lines is between 2 in. and 8 in.

To meet the ever-growing demand by processing foreign and indigenous crude in home refineries, the big oil companies which are operating in West Germany plan to erect new works in the Ruhr-Rhine district, which is the center of oil consumption of the federal republic. Here, about 20 million tons of annual crude (400,000 b/d) intake capacity is to be added to the German potential in the course of the next four or five years. Although hitherto the refining industry of the country—so far as the processing of foreign crude is concerned—was mainly concentrated at the North Sea ports of Hamburg and Bremen, where the plants can directly be reached by sea tankers, the Ruhr-Rhine district is far from the coast and, therefore, it is comprehensible that the oil companies decided to feed the new refineries by means of crude pipelines of large diameter.

At first, the plan was only to link either the Dutch harbor of Rotterdam or the German port of Wilhelmshaven with the oil processing plans in the Ruhr district and the newly projected refineries near Cologne and Duisburg. But soon the question arose as to whether a combination was possible between the needs of the German oil industry and the projected Trans-European

pipeline system between Marseille, the big French port on the Mediterranean, and the North Sea harbors of Rotterdam and Antwerp. The realization of this project—which is being studied by two associations which represent various groups of oil companies, viz., the SAPPEUR and the SOPIMER—would make it possible to supply the refineries in Central Europe, and even in Rotterdam and Antwerp, with Middle East crude via Marseille—thus obviating the tanker route around the Iberian peninsula—or, on the other hand, to feed the refining industry via Rotterdam with oil from the Western Hemisphere.

In the autumn of 1956, some of the companies active in Germany at first decided on the plan of a line between the German port of Wilhelmshaven at Jade Bay (North Sea coast) and the Ruhr-Rhine district. For this purpose, an operating company, the Nord-West Oelleitung GmbH, was established with an initial capital of 65 million German marks, divided as follows: Esso (S.O.N.J.) 47.2%; British Petroleum Co., 26.3%; Purfina (affiliate of the Belgian Petrofina group) 8.3%; Schloven-Chemie AG, 7.7%; the hydrogenation works Wesseling 6.8%; and Ruhrchemie AG, 3.7%. 3,500 workers are to be employed to complete the laying of the pipeline up to spring of 1959. The Wilhelmshaven pipeline is to have a diameter of 28 in. and a length of about 220 miles. Pipe is to be laid about 3 ft under the surface. In the first stage, a throughput of about 9 million tons of crude annually (180,000 b/d) is foreseen. Later on, with the aid of further pumping facilities, the capacity is to be increased to 20 million tons annually (400,000 b/d). The line is planned to run from Wilhelmshaven in a southwesterly direction to the towns of Meppen and Lingen; then to the northern outskirts of the Ruhr district near Dinslaken, crossing the Rhine at Leverkusen; and then along the left bank of the river running down to Cologne and Wesseling.

Two large oil groups, viz., Shell and Gelsenberg Benzin AG, are not participants in the Wilhelmshaven project. It seems probable that Shell, as well as Gelsenberg, will merge its transport interests with the plans of SAPPEUR which at the time of its founding was a special project of Royal Dutch-Shell. If this should happen, the first part of the trans-European pipeline would probably be built from Rotterdam via Breda to Godorf, south of Cologne, where the new Shell refinery will be erected—with a branch line via Wesel (on the Rhine) to the Gelsenberg hydrogenation plant near Gelsenkirchen. Later on, this pipeline from Rotterdam to the Rhine might be continued to Marseille. As Shell intends to finish the first stage of its building program at Godorf as early as 1960, a decision regarding the Rotterdam pipeline project is soon expected.

Table 1 gives a summary of those pipelines in West Germany which are more than 3 miles long. Among the longest crude pipelines is the 23-mile line from Duisburg Rhine port to Gelsenkirchen (hydrogenation works of Gelsenberg and Schloven). Second is the pipeline from the Heide refinery (Holstein province) to the Kiel canal (Brunsbuettelkoog harbor) through which foreign crude is pumped to Heide a distance of 19.8 miles. Parallel to this line runs another pipeline conveying finished products from the Heide refinery to the jetties at Brunsbuettelkoog. Furhermore, the 6-in. pipeline which runs from the Eldingen oil field a distance of 17.9 miles to the gasoline station at Nienhagen is worth mentioning. Some weeks ago it was extended 16.5 miles to the Misburg refinery near Hanover.

To utilize the natural gas which had been found in the '30's near Bentheim (Elmsland district), an 8-in. pipeline 47.8 miles long was built which connects the Bentheim gas field with the Chemical Works at Huels. Several other medium-sized lines were laid some years ago when gas was discovered at Rehden (Weser-Ems district) and in the neighborhood of Darmstadt town (upper Rhine valley). From Rehden, a 7⅝-in. line, 37.3 miles long, runs to the iron and steel works near Osnabrueck where the gas is used for heating purposes. From the gas fields of Stockstadt, Pfungstadt, Eich, and Wolfskehlen in the upper Rhine district, pipelines were laid to chemical plants at Ludwigshaven and Hoescht, where the gas is used for the production of petrochemicals. In the Elmsland district some gas pipelines were built to connect the gas fields near the Dutch border with Bentheim and Huels Chemical Works, respectively. END

TABLE 1

German Pipelines

From:	Crude Lines to:	Miles	Diameter (Inches)
Duisburg	Gelsenkirchen	23.0	8
Heide	Brunsbuettelkoog	19.8	6
Eldingen	Nienhagen	17.9	6
Nienhagen	Misburg	16.5	6
Osterwald	Holthausen	13.8	5
Hankensbuettel	Hohne	13.5	2½
Ruehlertwist	Osterwald	10.6	5
Wietingsmoor	Barenburg	8.7	5
Voigtei	Liebenau	8.2	6
Duisburg	Oberhausen	6.8	6
Ruehlermoor	Dalum	6.2	6
Hohne	Beedenbostel	5.8	4
Petroleum Harbor Hamburg	Refinery Hamburg-Harburg	5.6	14
Berkhoepen	Stederdorf	5.5	3
Calum	Holthausen	5.4	4
Dalum	Geeste	5.3	6
Georgsdorf	Osterwald	5.0	4
Steimbke	Hagen	4.9	8
Reitbrook	Warwisch	4.3	8
Suderbruch	Gilten	4.0	6
Fuhrberg	Oldau	3.7	4
Hemmelte-West	Bartmannsholte	3.6	6
Georgsdorf	Osterwald	3.6	4
Fuhrberg-Ost	Hambuehren	3.4	6
Thoeren	Wietze	3.3	8
Thoeren	Wietze	3.3	4
Others		36.3	
Total		248.0	

Natural-Gas Lines

Bentheim	Huels	47.8	8
Rehden	Osnabrueck	37.3	7⅝
Pfungstadt	Hoechst	21.7	4
Stockstadt	Ludwigshafen	21.4	8
Frenswegen	Bentheim	11.5	8
Rehden	Aldorf	9.1	3½
Frenswegen	Georgsdorf	7.3	3
Itterbeck-Halle	Frenswegen	7.2	5
Eich	Stockstadt	6.9	4
Adorf	Georgsdorf	5.0	5
Wolfskenlen	Stockstadt	4.7	6
Stockstadt	Worms	4.0	3
Frenswegen	Nordhorn	2.5	3½ and 2⅜
Total		186.4	

Products Lines

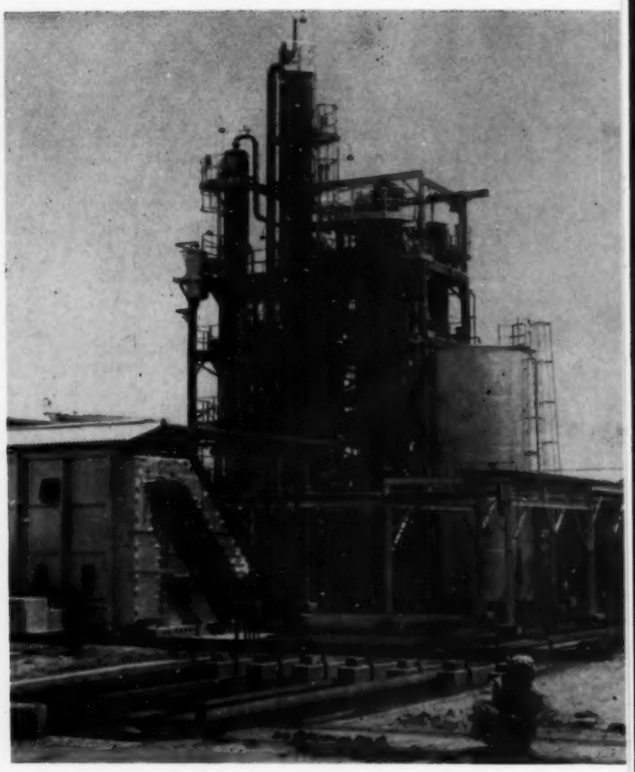
(mostly casinghead gas from oil fields)

From:	To:	Miles	Diameter (Inches)
Heide	Brunsbuettelkoog	19.8	5
Hohne	Beedenbostel	6.5	2
Hohne	Beedenbostel	6.5	2
Dalum	Holthausen	5.4	5
Suderbruch	Steimbke	4.2	4
Georgsdorf	Osterwald	4.0	6
Others		17.5	
		63.9	
Total length of all existing pipelines		498.3	

Planned Pipelines

From:	To:	Miles	Diameter (Inches)
Wilhelmshaven	Ruhr-Rhine district	About 220	28
Rotterdam	Godorf (on Rhine)	About 150	

General view of Iraq's new lube plant: Process units (from left to right) are: clay percolation, acid treating, propane dewaxing, furfural treating, propane deasphalting and asphalt blowing, vacuum distillation. Blending, canning, and can-manufacturing facilities are in the foreground (photo, courtesy Foster Wheeler Ltd.)



Furfural unit at the Daura refinery.

New Daura plant meets Iraq's national lube requirements

LUBRICATING-OIL requirements of Iraq now are being largely met by the output of a new lube plant recently placed on-stream at Daura, near Baghdad, by the Oil Refineries Administration of Iraq. Only a few special types of oil now need to be imported. The plant has the capacity to produce 500 b/d of finished lubricants.

Contract for design and construction of the plant was let in April 1955 to Foster Wheeler Ltd., London. Completion was almost exactly two years later, despite difficulties arising in connection with Suez.

The lubricating-oil refinery comprises some nine process units, together with the boiler and power plant, can and drum making plant, and the various offsite facilities. Seventy tanks of various sizes, totaling 192,000 bbl capacity, were constructed on site from rolled plates.

Process units included in the plant include vacuum distillation, propane deasphalting, asphalt blowing, furfural treating, propane dewaxing, clay percolation, and acid treating.

With the exception of a small amount of alloy pipe, all piping on the project has been site-fabricated from random lengths shipped out there, involving altogether over 85 miles of pipelines in sizes up to 24 in. in diameter.

The new power-plant extension comprises a 2,000 turbo-alternator, and power from this has had to be integrated with that from the other generators and led across to the lube plant where there is a substation, together with a small diesel-driven emergency lighting generator. This latter machine will provide, in particular, a very essential source of power for operating instruments, and will facilitate safe and careful shutdown of the plants in the event of a power failure from the main generating station. Altogether, over 35 miles of overground and underground cable for lighting and power purposes have been run, together with some 13 miles of steel and asbestos conduit.

The Wadi Tharthar project was built on a virgin site located just south of the existing refinery. Foundations for all major equipment had to be piled, and there was a considerable amount of integration to be effected with the existing refinery, including extension to the boiler and power plant and tie-ins wtih numerous utility and oil pipelines. Altogether, some 1,100 piles were driven and over 10,600 cu yd of concrete were laid for the new foundations. Over 2,000 yd of new roads have been built and surfaced within the Daura refinery fence. Preparation for this foundation work, including grading of the site, entailed the movement of 50,000 cu yd of earth.

Most categories of equipment, such as pressure vessels, compressors, API line pipe, etc., were purchased in the United Kingdom, Germany, Italy, France, and the USA.

The large building for the can and drum making and filling plants, which covers an area of 60,000 sq ft, had been completely erected on the site by the beginning of 1956. It was immediately used for storage of plant equipment as this arrived on site, and also for temporary office accommodation.

The construction force was gradually built up to a total of 1,200 men, the great majority of whom were recruited locally. Only a few dozen expatriated personnel were required for supervision; the skilled trade requirements, including carpenters, pipe welders, pipe fitters, instrument fitters etc., were filled by Iraqis.

As mentioned earlier, the lubricating-oil refinery has been completed on time, in spite of shipping difficulties caused by the international situation. Several shipments of material, including some of the main towers, had to be sent around the cape, and there were numerous other shipping delays outside the control of Foster Wheeler. Altogether, some 8,700 tons of materials have been shipped to the site for this project; and this quantity, of course, excludes materials such as bricks and cement, which are available locally. END

PROTECTION

SCHLUMBERGER
THE OIL MAN'S
PROTECTION

REGENERATES IN SITU!

THIS IS THE CATALYST

Sinclair-BAKER RD 150
Platinum Reforming Catalyst

THESE ARE THE REASONS WHY

BAKER'S RD 150 continues to prove the most efficient of all reforming catalysts—producing important yield increases at high octane levels and high octane reformates from low grade naphthas.

The long period of initial operation is unmatched by any other catalyst . . . and beyond that, *RD 150 is regenerative in situ!* Cost is sharply reduced to lowest level.

RD 150, a joint development of Baker & Co., Inc. and Sinclair Research Laboratories is unique. It is being used in highly successful production by many producers in this country and abroad. A Baker representative will be glad to give you detailed information, upon request.

All data of confidential nature are of course treated accordingly.

BAKER & COMPANY, INC. CATALYSTS

BAKER & CO., INC.

113 ASTOR STREET, NEWARK 5, NEW JERSEY

NEW YORK • SAN FRANCISCO • LOS ANGELES • CHICAGO

ENGELHARD INDUSTRIES

SEND FOR BROCHURE
The Role Of Platinum Group Metals As Catalysts

THE HUB OF PLATINUM METALS RESEARCH

Abrupt seasonal fluctuations in demand may be minimized by . . .

NEWER USES FOR MIDDLE DISTILLATES

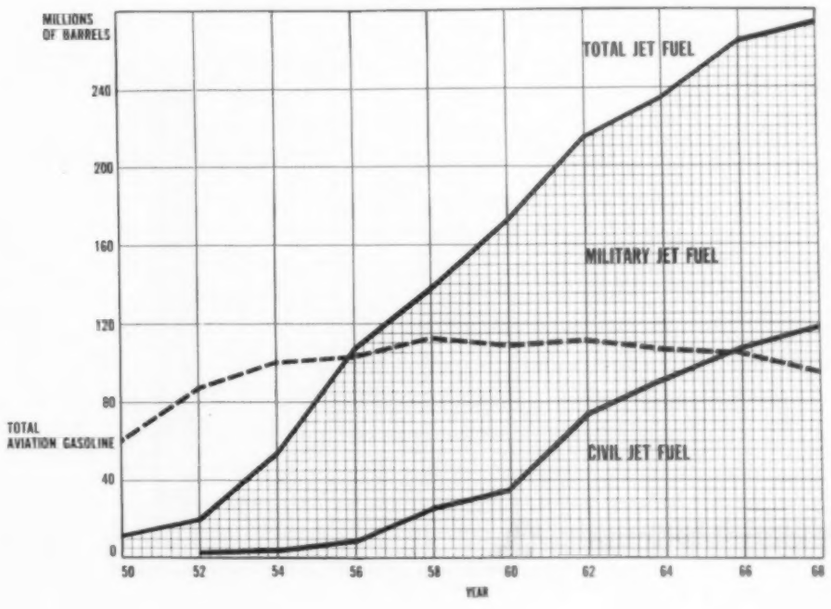
THE seasonal factor in demand which adds to the unattractiveness of middle distillates may be further minimized within the next few years as a result of the development of year-around oil-fired air conditioners and of the very rapid growth in jet-fuel consumption. While a substantial air conditioner load is still some years away, this is not the case with jet fuels.

In 1956 domestic demand for jet fuels in the United States totaled 70,026,000 bbl, while demand for aviation gasoline was only slightly higher at 74,746,000 bbl. Relative position of the two fuels changed in the early months of this year. US Bureau of Mines figures for the first half of the year indicate that consumption of jet fuels is slightly higher than that of avgas.

In an article in a recent issue of *Oil, Lifestream of Progress*, house magazine of the Caltex group of companies, H. Austin Murray wrote that jet-fuel demand on a worldwide basis is higher than avgas. An accompanying chart (Fig. 1), prepared by Mr. Murray, traces the relative growth of the two fuels, and estimates the future trend.

Some authorities believe that the rate of jet-fuel growth will be even greater than

Fig. 1 Worldwide demand for jet fuel now exceeds aviation gasoline.
(Chart prepared by H. Austin Murray, California Texas Oil Co. Ltd.)



that indicated in Fig. 1. Mr. Murray keeps his future estimates low because he feels that delivery of the DC8 and Boeing 707 intercontinental jets cannot possibly be made on the schedule now visualized, and he points to a recent cancellation of part of its order for Viscounts by Capital Airlines as an indication that some airlines have overbought.

A more optimistic view is taken by the recent Cornell Aeronautical Laboratory forecast submitted to President Eisenhower's Aviation Facilities Planning Group. In this report, it is estimated that in the 1960-62 period USA airlines will be operating an average of 805 reciprocating-engine-powered planes out of a fleet of 1,429. On a percentage basis, there will be 56.2% reciprocating, 26.2% turboprop, and 7.6% turbojet.

By 1965 common-carrier planes will be only 28.8% 'reciprocating-engine-powered, compared with 45.2% turboprop and 26% turbojet. Ten years after that, only 15.6% will be powered by reciprocating engines—and these in small planes, the laboratory believes. Turbojets will be up to 47%, and turboprops to 40.4% of the total.

Last year the average composition of jet fue's manufactured by USA refineries was 77% gasoline, 17% kerosine, and 6% distillate. In early months of the present year the gasoline content was down to 74%, while kerosine was up to 19% and distillate to 7%.

Fuel-oil distributors as well as refiners have shown great interest in the recent development of an oil-fired home air conditioner resulting from a million-dollar research program sponsored by Esso Research and Engineering Co., Gilbert and Barker Manufacturing Co., and Servel Inc. Servel has manufactured oil- and gas-fired refrigerators for many years, while Gilbert and Barker has been active in the manufacture of oil burners for home heating.

The new "Sun Valley" all-year air conditioner consists of a low-pressure air-atomizing burner and a cast refractory combustion chamber, plus an absorption refrigeration unit and a blower-and-filter section. A water-cooled condenser and absorber is employed, usually with a water tower to conserve water.

A feature of the newly developed burner is its ability to operate efficiently at 0.5 to 0.6 gal per hour while on a cooling cycle, and up to 0.9 gal per hour for heating. It can be adjusted to firing rates as low as 0.4 and as high as 1.4 gal per hour.

It is claimed that the unit will have low maintenance costs and come up to 10% in operating cost when compared with electric refrigerating units. The home owner can change from heating to cooling, or vice versa, by a flip of the thermostat.

In homes where the oil-fired conditioner is installed, it is anticipated that three or more additional oil deliveries per year will be required—during the normally slack season. The load may increase as much as 600 gal to 1,000 gal per year, depending on size of home and weather conditions.

Servel thus far has released 100 units for home installation. Results of these trial installations will be watched with great interest by the trade.

There is an apparent leveling off in the upward trend of domestic oil-burner installations in the United States. Net increase in burners in 1955 was 613,355. Last year the increase was 477,217, bringing the total in use on January 1, 1957 to 8,732,445.

In the first six months of the current year, new installations were 14% fewer than in the first half of 1956. The total was 230,275, compared with 269,482, according to figures gathered by *Fueloil and Oil Heat* magazine. Based on this record, the editors of that publication estimate that the increase this year will be about 468,000, bringing the total at December 31, 1957 to 9,200,000. Estimates are based on the usual seasonal pattern of burner sales, but may be affected by the rate of new home building during the latter half of the year.

The domestic burner industry is meeting severe competition in some areas from natural gas. New home builders are being given concessions on gas mains and laterals so that gas-heating units may turn out to be about $50 per home cheaper than oil installations. This is enough of a swing in costs to cause builders to adopt gas instead of oil.

In some areas, the new home market appears definitely lost to gas. Baltimore is one example. In areas where both gas and electricity are distributed, it is charged that electric rates have been rising while gas has been largely unchanged even though gas costs have risen. Oil dealers charge that the utilities are building their gas load at the expense of users of electric energy. In some areas, gas now appears to be cheaper than oil on a delivered Btu basis.

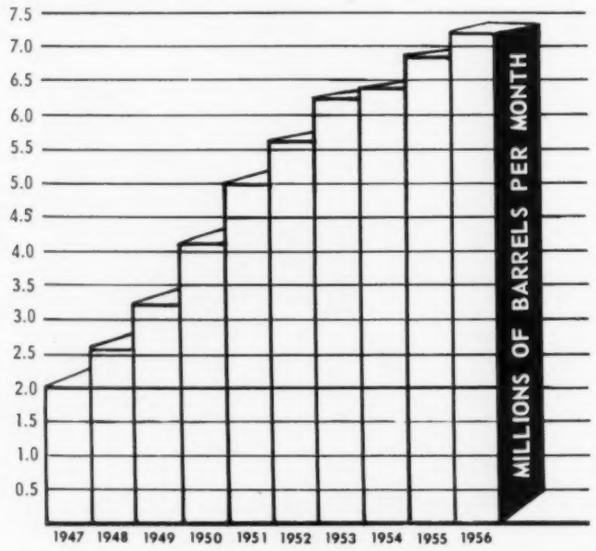
Gas distributors have been active in advertising and sales promotion work in recent years, but oil distributors now are countering with cooperative promotion work. Robert Gray, editor of *Fueloil and Oil Heat*, has been largely responsible for this work through his "Oil Heating Market Reports." In 1956, a total of about $1 million was spent on cooperative promotion programs in some 26 markets which Mr. Gray and his associates had surveyed. It is anticipated that more communities will be covered this year among the 40 in which detailed surveys have been made.

Last year fuel-oil distributors lost 125,000 installations to other fuels, principally gas. This compares with 76,000 in 1955. The percentage of loss has been about 1% in recent years.

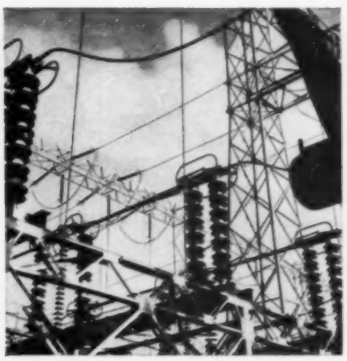
The demand trend in railroad diesel fuel also is tending to level off, although locomotives in service continue to be increased substantially from year to year. Some carriers are switching to heavier and cheaper fuels.

In the first five months of 1957, railroads purchased 30.1 million barrels of distillate fuel, compared with 29.4 million barrels in the same period a year ago. The increase was only 2.2%. The business is highly satisfactory to refiners because the seasonal factor in deliveries is virtually absent. Volume depends largely on the general trend of business. This contrasts with the severe seasonal swing and the weather effect on domestic fuel. This past winter, for example, distillate-fuel sales were only a little higher than in the previous year, although nearly a half million more burners were in use.

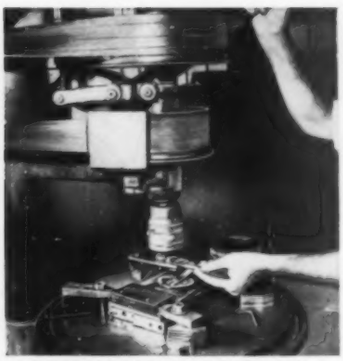
Fig. 2 Growth in railroad use of middle distillates as diesel fuel is leveling off.



STEEL, with its giant equipment, uses Cities Service lubricants in ever mounting quantities. The list of Cities Service customers reads like a "Who's Who" of the steel industry and it's growing all the time.



ELECTRIC POWER companies use Cities Service Diesel Lubricating Oil to set low-cost power generating records. Proof again that high-quality Cities Service Diesel Oils are tailored to their job.



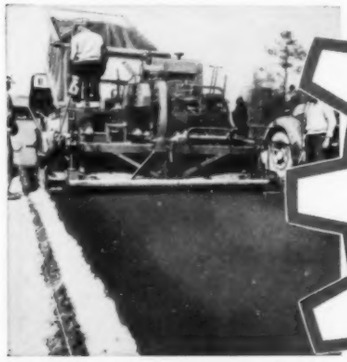
MACHINE SHOPS find Cities Service Cutting Oils the answer to longer tool life and greater precision. Cities Service makes a complete line of quality cuttings oils for every job requirement.

PAPER in many uses requires huge quantities of highly refined wax and gets the best in Cities Service Pacemaker Wax . . . used for milk cartons, wax paper, straws and dozens of other paper products.

MINING is both a quantity and quality user of lubricants. Cities Service tailors precision lubricants to serve the needs of this basic industry, symbolized here by a view of the famous Mesabi Iron Range.

FARMING is more and more a mechanized industry, and more and more an important customer for Cities Service products. Farming consumes more petroleum than any other industry.

Geared to the needs of fast rolling American Industry



ROAD BUILDING calls for enormous quantities of Cities Service petroleum products—all the way from fuels to lubricants to asphalt road topping. Future demand looms larger and larger, as America launches the greatest highway building program in world history.

AVIATION, with its mounting requirements of higher octane gasolene and jet fuels, finds Cities Service a major supplier. With its ultramodern refinery facilities, Cities Service is capable of producing aviation fuel components in huge quantities.

CITIES SERVICE

Assuming an average consumption per burner of 1,770 gal in a normal heating season, the 9,200,000 home and apartment heating installations burning No. 2 fuel now represent a market for 388 million barrels of oil per year. This compares with a prewar total of 97 million barrels.

The 1956-57 heating season was considered to be 7% below normal, with the result that consumption per burner was 1,653 gal, according to estimates of *Fueloil and Oil Heat*. Total burner consumption was about 341 million barrels. If weather conditions are normal during the coming season, there should be an increase of about 47 million barrels in demand. With a possible swing in demand over a five-month period of 47 million barrels or more, it is small wonder that oil-industry economists have been asking for a reasonably good method of long-distance weather forecasting. Until that is attained, about all the industry can do is to build a good stock position every fall and hope to get rid of it. In the meantime diesel fuel, jet fuel, and a possible market for year-around airconditioning are being carried assiduously. END

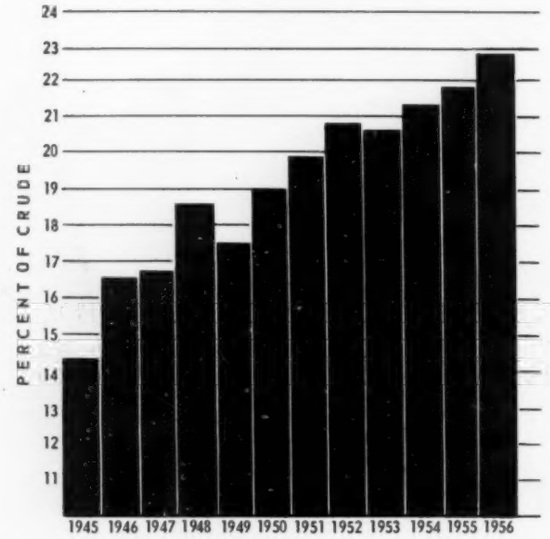


Fig. 3 Refinery yields of middle distillates.

DIESEL LOCOMOTIVE UNITS ON ORDER

Type	*Aug. 1 1957*	*Aug. 1 1956*	*Aug. 1 1955*	*Aug. 1 1954*	*Aug. 1 1953*
Passenger	2	24	47	4	62
Freight	111	62	244	96	170
Pass. or Ft.	226	657	—	8	8
Switch	26	94	176	15	244
	395	837	467	123	484

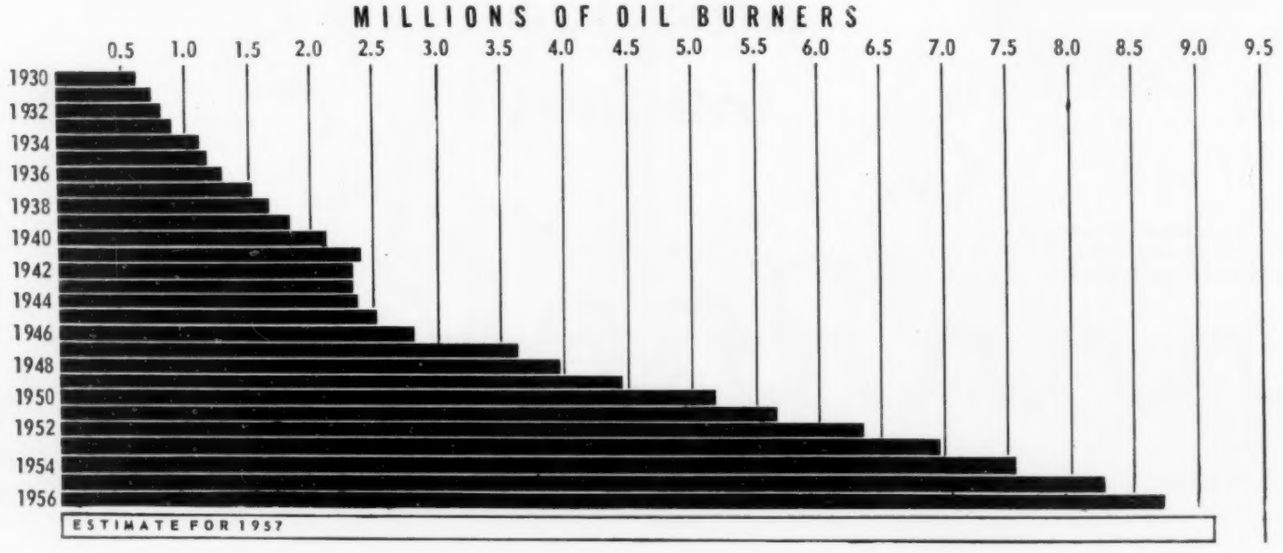
USA OIL-BURNER INSTALLATIONS

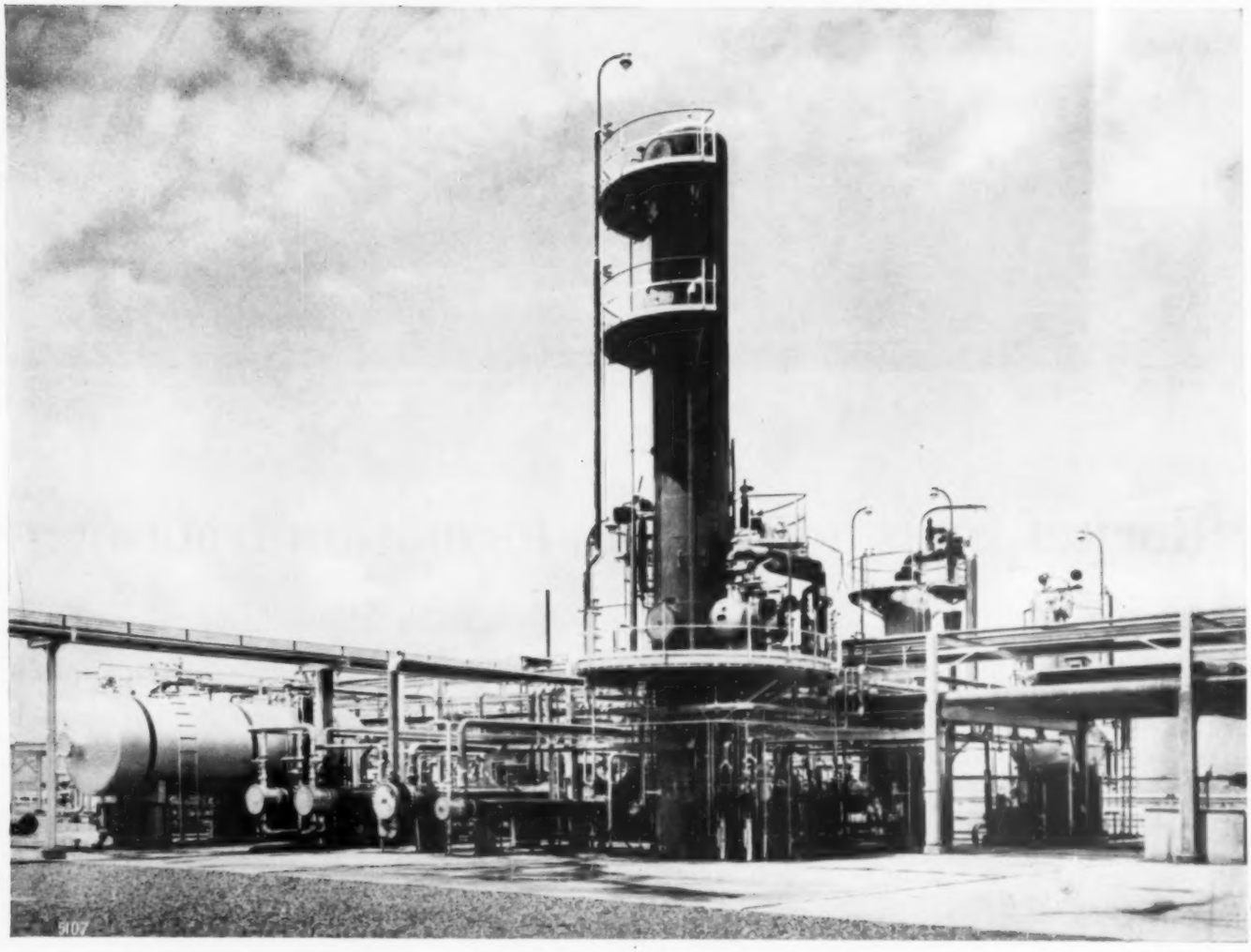
	1956	1955
Burners in use Jan. 1	8,255,228	7,641,973
New homes	304,243	376,199
Replacements	141,838	119,483
Conversions	263,111	313,123
Total	709,192	808,805
Losses to other fuels	125,000	76,067
Burners in use Dec. 31	8,732,445	8,255,228

WORLD AIRLINE TRANSPORTS ON ORDER

Year of Delivery	*1957*	*1958*	*1959*	*1960*	*1961*
Four Engine Piston	229	117	—	—	—
Medium Range Piston	114	26	—	—	—
Long Range Turbine	16	46	175	162	14
Medium Range Turbine	103	143	37	57	30
Total on Order	462	332	212	219	44

Fig. 4 Oil-burner sales were lower in the first half of the year, but total installations may approximate 9.2 million by December 31.





Kwinana Hydrofiner, Western Australia. Photo by courtesy of The British Petroleum Co. Ltd.

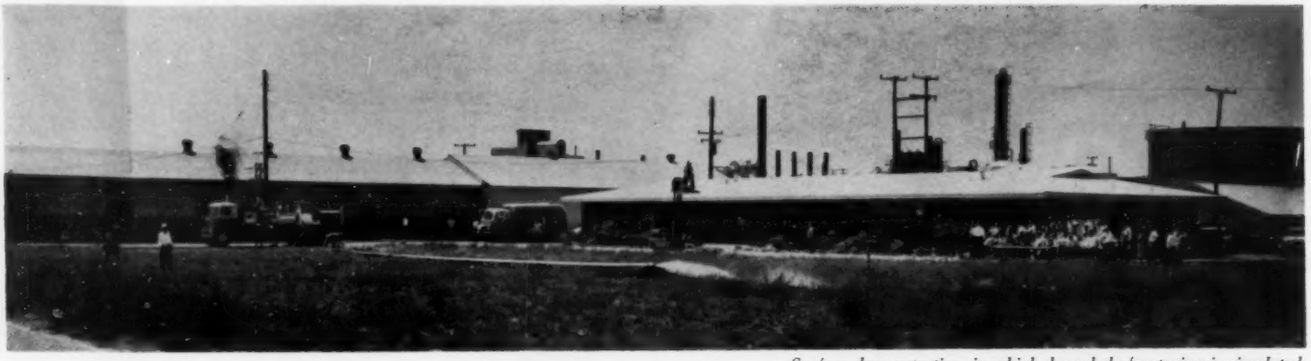
Spence Catalysts for Research and Industry

This British Petroleum Company unit, which desulphurises high speed diesel oil, uses Spence COMOX* catalyst.

*COMOX is the registered trade mark for Spence cobalt and molybdenum oxides on alumina catalyst.

Peter Spence & Sons Ltd

Widnes • Lancs • England
also at London & Bristol



Surface demonstration, in which down-hole fracturing is simulated, shows normal down tube pumping rate through small orifice.

Rocket fuels adapted to formation fracturing

SOLID rocket propellant fuels have been applied for the creation of high pressures required for formation fracturing in a new tool developed by BJ Service Inc. which has generated up to 5,000 hydraulic horsepower in surface and field tests.

Called the Frac-Assist, it is a packaged power unit which is located in the tubing string through which the fracturing fluid is pumped. This new tool is located immediately above the perforated tubing, opposite the zone or zones to be fractured. Normal fracturing procedures are followed at the start, with force supplied by surface pump trucks which pump fluid through the Frac-Assist tool. After this surface-pumped force has reached the zone to be fractured, it is assisted or boosted by triggering the Frac-Assist tool. This is accomplished from the surface by introducing a triggering plug into the frac fluid stream. When this plug enters the Frac-Assist tool, it compresses a firing cam and detonates blank cartridges which initiate a controlled burning of a gas-generating fuel. The gas exerts a tremendous, nearly instantaneous downward surge behind the fracturing fluid already in the tubing. This high-injection high-pressure boost produces a super fracturing force to create multiple, productive features.

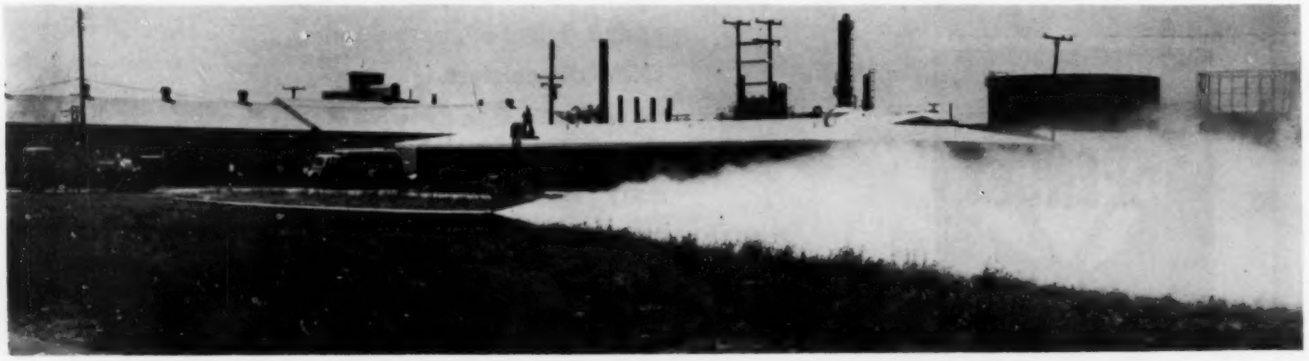
The tool was demonstrated recently at the research and development section of BJ Service in Long Beach, Calif. In the demonstration, a high-pressure pumping unit initiated the pumping stream of water at approximately 6 to 6½ bbl per min. A stream of approximately 25 ft was ejected from the nozzle end of the string. The triggering plug was then released into the string. With an almost unnoticeable "thunk," the Frac-Assist tool fired, and a tremendous jet stream of water and vaporized spray hissed through the air 125 ft—more than four times the length of the original truck-pumped force.

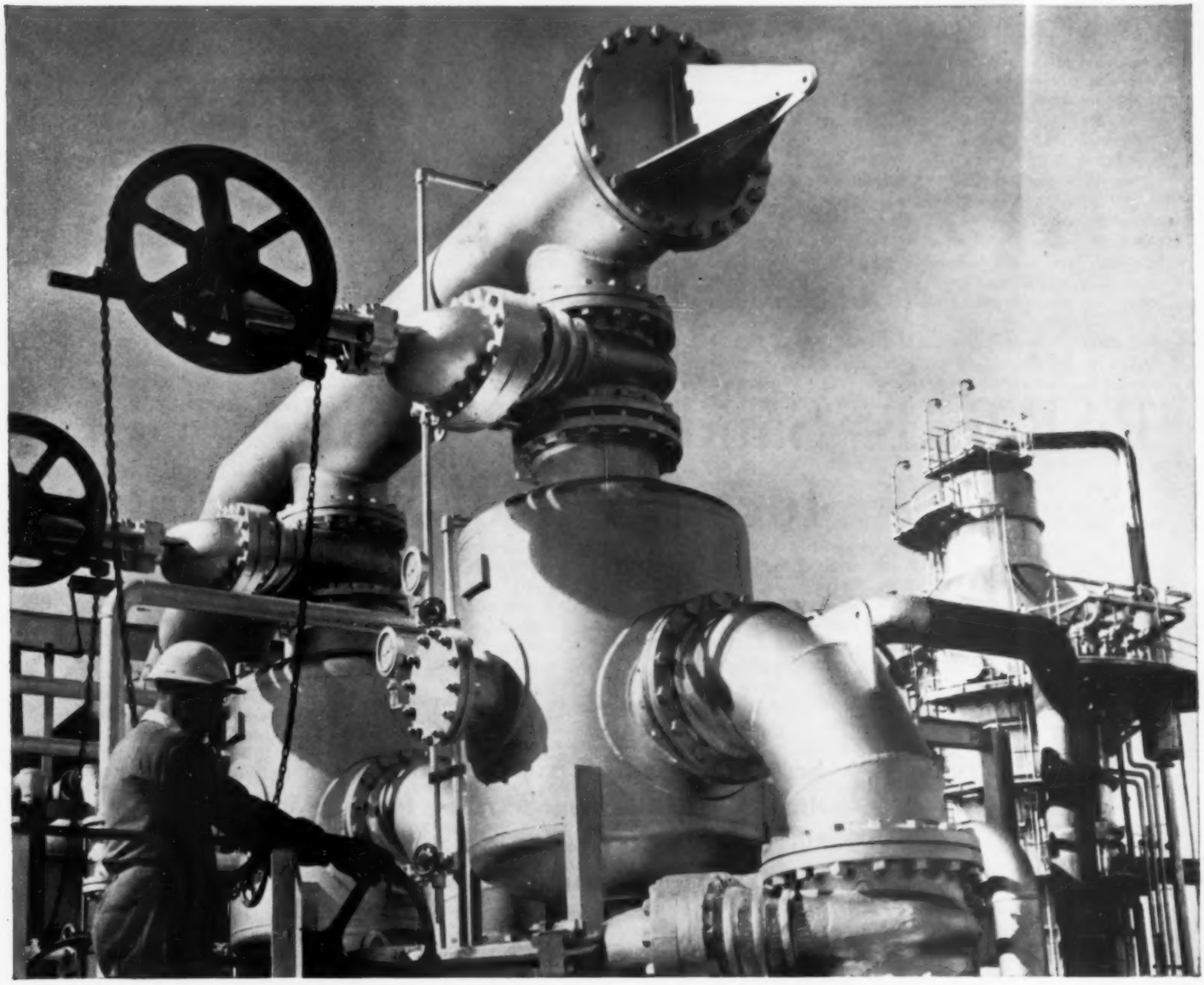
M. B. Riordan, vice president in charge of engineering and manufacturing for BJ Service, explained that the primary purpose of the new tool is to eliminate the friction and fluid losses inherent in pumping fluid from the surface to fracturing points thousands of feet below the surface. Special emphasis was put on designing a down-hole tool which could generate its own high-injection rate without creating an explosive force in the well. The answer was achieved in this plug-triggered device utilizing a new solid propellant fuel. This new fuel is a variation of the solid rocket propellant devised by Grand Central Rocket Corp. for powering the third stage rocket which is scheduled to carry the earth satellite to its line of orbit. The fuel, resembling an asbestos wrapping which surrounds the gas-generating chamber of the Frac-Assist, cannot be ignited by normal shock, friction, or heat. A fuel sample was struck with a hammer, rubbed with sandpaper, and exposed to open flame. Finally, an igniter strip was used to "fire" the fuel and produce a controlled, even burning.

In the surface test, one-fourth of the normal charge was used. This charge produced approximately 1,280 hydraulic horsepower, and increased pumping to 26 bbl per min, from 6 or 6½ bbl per min.

Field tests have been made under a wide range of well conditions and problems. To date, however, these tool runs have been in "incurable" wells where fracturing pressure improvement could be measured, but where no production improvement could be gained. It now is being offered to the industry on a commercial basis. END

Tremendously increased rate with BJ Frac-Assist is shown through same orifice.





BP REFINES IN AUSTRALIA

THE £A40,000,000 Kwinana refinery, the largest in the Southern Hemisphere, is situated 17 miles south of the Port of Fremantle and is operated by BP Refinery (Kwinana) Limited, one of BP's Australian Associates.

Kwinana Refinery was officially opened by the Governor General, Field Marshal Sir William Slim, in October 1955 – three and a half months ahead of schedule.

In the first year of operation the refinery processed 2,000,000 tons of crude oil, producing petrol, kerosene, diesel and fuel oil for the markets of Australia, New Zealand and neighbouring countries.

Preliminary work has now started on the new expansion scheme. This includes the erection of the latest design of catalytic reforming plant for upgrading low octane motor spirit, and the building of increased storage facilities.

Products from the refinery are marketed under the green and yellow BP Shield a familiar symbol for progress on the land, sea and air routes of the world.

The BP Shield is the symbol of the world-wide organisation of

The British Petroleum Company Limited

BRITANNIC HOUSE · FINSBURY CIRCUS · LONDON · EC2

PROGRESS IN WELL-COMPLETION METHODS

PART II—Sand control and formation of well cavities

by **Lester C. Uren,** *Emeritus Professor of Petroleum Engineering, University of California.*

Screen pipe, gravel packs, plastics, explosives, hydraulic jets, drain holes—all are modern aids for the exclusion of sand from the producing formation, or for the maintenance and support of well cavities within the reservoir rock.

In this, the second of a series of three articles reviewing progress in well-completion techniques, methods of dealing with the problem of sand influx from poorly consolidated producing formations will be reviewed. Also, the advantages of well cavities within the reservoir rock and possible methods of forming and maintaining such cavities will be briefly discussed.

In many oil- and gas-producing fields, the producing formations consist of poorly consolidated sand and shale strata which tend to cave into the wells and disintegrate when subjected to the erosional effects of flowing oil and gas. To restrict this tendency, casing must extend through the producing strata to support the walls of the wells; and casing perforations, provided to admit fluids to the wells, must often be screened to prevent access of fine-grained detrital material with the flowing oil and gas.

The walls of the wells usually close in about the perforated liners, and the annular spaces between them and the original drilled walls of the wells become filled with cavings and detrital material. Sand and shale particles tend also to accumulate in and about the screened perforations—further restricting production of oil and gas. Some of the sand particles pass through the perforations and must occasionally be removed from inside the liners by "cleanout" operations. The finer sand and shale particles often remain afloat in the well fluid, and are removed to the surface with the oil. The gritty character of this fine sand results in rapid scouring and abrasion of pump valves, seats, and plungers and of other well equipment with which it comes into contact—necessitating frequent and costly maintenance and repair operations. Sand particles entrained in rapidly flowing high-pressure natural gas produce a sandblasting effect on all metal equipment with which they come into contact—often enlarging the liner perforations and screen openings until they no longer serve their intended function.

Indiscriminate production of sand from strata about the walls of the wells will result in formation of cavities which may permit extensive caving of interbedded shale strata. Caves may deform or collapse the liners. Caving conditions which extend into the cap rock overlying the oil and gas reservoir may admit high-pressure water from overlying formations to the reservoir strata—thus greatly curtailing production of oil and gas.

Use Of Screen Pipe In Sand Control: In the first installment of this series of articles, which appeared in the September issue of WORLD PETROLEUM, methods of perforating casing to admit oil and gas to the wells from producing formations were briefly described. These methods involved either drilling round holes ("shop-perforated pipe") or cutting narrow slots ("slotted pipe") through the walls of the pipe before it is inserted into the well, or gun-perforating the pipe after it is in place in the well. The ¼-in. to ¾-in. round holes provided in shop-perforated pipe are not effective in excluding unconsolidated sand (see Fig. 1-A). Slotted pipe is partly effective if the slot openings are not too wide, but even the

narrowest slots which are practical in screen pipe manufacture will allow the finer sand particles to pass (see Fig. 1-B).

Some authorities have claimed that horizontal slots cut at right angles to the axis of the pipe are more effective in sand exclusion than longitudinal slots having their longer dimension parallel with the axis of the pipe. A "shutter" opening in which the slots are inclined upward from the outer to the inner wall of the pipe is also considered to have some advantage, but is difficult to cut. Others believe that the form and position of the perforations has little or no influence in determining the effectiveness of sand exclusion; that the sand is held in suspension in the well fluids and, for all practical purposes, behaves as a part of the fluid.

Wire-wrapped Screen Pipe: The difficulty experienced in restraining influx of the smaller sand grains with all types of perforations has led to the use of screens of various types—either wrapped around the outside of the pipe over the perforations, or supported in the perforations. The first and most widely used type of screen developed for this purpose was the wire-wrapped screen, in which closely spaced coils of wire are tightly wrapped around the pipe—in effect forming very narrow, slot-shaped openings over the round holes in shop-perforated pipe. The same type of screening may, of course, be applied to slotted pipe (see Fig. 1-C). A common difficulty with this type of screen is that of lowering it into place in the well without damaging or displacing the screen by contact with the rock walls of the well. Also, it is likely to become clogged with clay scraped off the wall of the well during insertion. This latter difficulty however, can usually be remedied by jetting water or oil through the screen openings from inside the liner after it is in place in the well.

When round wire is used in manufacture of screen pipe, the openings between adjacent wires are of such form that sand grains are likely to become lodged between the wires—thus obstructing the screen openings and restricting passage of fluids through the casing perforations. To avoid this, wire of rectangular, triangular or *T*-shaped cross-section may be used. The narrowest part of the screen opening is then on the exterior surface of the screen, and any sand particles which are small enough to pass this opening will have free passage through the screen—thus minimizing clogging tendencies.

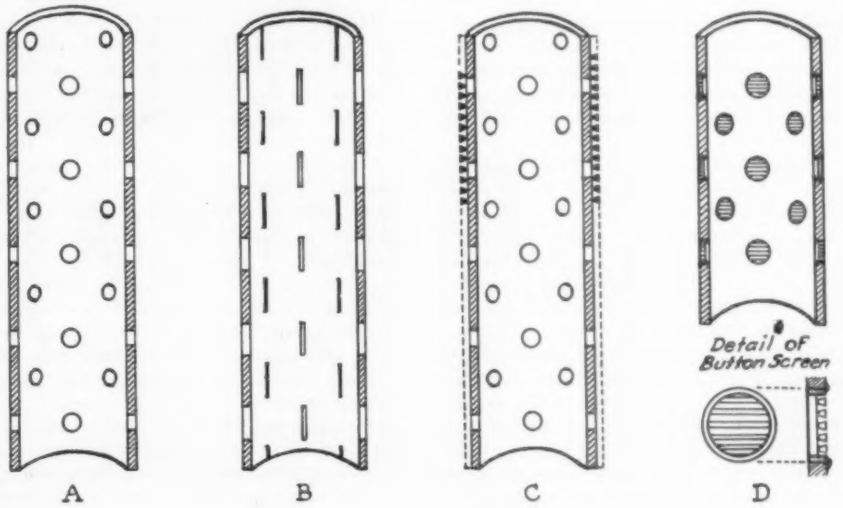
To strengthen wire-wrapped screening and reduce the possibility of its being displaced by contact with the walls of the well, it is usually welded to the pipe at the ends and longitudinally along areas where use of fusion metal will not obstruct the openings through the casing perforations. In one type of wire-wrapped screen pipe, the exterior surface of the pipe is provided with projecting ribs which support the wire wrapping so that it is free of the pipe surfaces through which the perforations are formed. After passing through the screen openings, fluids may move longitudinally along channels between the ribs to round perforations through the wall of the pipe. The same effect may be secured by cutting shallow longitudinal grooves between adjacent perforations in the outer wall of the pipe.

Button Screen Pipe: To minimize damage and clogging by contact with the walls of the well, a variety of screen pipe has been developed in which slot-shaped screen openings are formed within the pipe perforations, so that no metal projects beyond either the outer or inner walls of the pipe. Brass disc-shaped "buttons," with narrow slot openings cast or cut in them, are screwed into threaded round holes drilled through the wall of the pipe. In another variety, the buttons are supported on a counter-sunk shoulder and held in position by peening the pipe metal over the edges of the buttons (see Fig. 1-D). In years passed, button-screen pipe was widely used in some of the California fields; but, because of its high cost and development of satisfactory and less expensive types of slotted pipe with narrow openings, it is now rarely employed.

Principles of Screening: Many laboratory and field studies have been made to determine the efficacy of screen pipe in controlling sand influx into producing wells. Research projects have sought to determine the influence of screens in restricting flow of oil and gas through casing perforations and to determine the most effective size of screen opening. The size of the screen openings should be as large as possible without permitting continued passage of sand through them. Tests[3] have indicated that sand particles will form a permanent "bridge" over a slot-shaped screen opening if it is no wider than twice the diameter of the sand grains. This is for spherical grains of uniform size. Angular grains, which are common in nature, will bridge over somewhat larger screen openings. Usually sand grains are of assorted sizes and shapes, and a practical basis for determining the proper size of screen opening is to make a screen analysis of the sand and then assume that the size of screen to use will be that which will retain 10% of the sample. This would at first permit some of the finer grains to pass through the screen, but eventually the coarser particles will bridge over the screen opening; and these coarse sand particles will then, in turn, form a bridge for finer particles until a stable condition is eventually achieved.

Research has also indicated that the rate at which fluid will pass through screen pipe is essentially independent of the perforation pattern and is determined by the number of screen openings and their size, or the total perforation density.[8] For example, with only three ½-in. perforations per linear foot of pipe, a well can produce only about half as much fluid as if the hole were uncased. Six perforations per foot will interpose comparatively little flow resistance. Studies have also been made of the pressure loss resulting from formation of a sand bridge over a slot-shaped opening, and this is found to be small—or even negligible—if the slot width is equivalent to at least twice the grain size of the 10 percentile size of sand grain, as measured by a screen analysis. The pressure loss created by the pipe perforations alone is also small, compared with the pressure loss which occurs in moving fluids through the surrounding sand.[7] It is believed that a slotted liner does not affect normal flow conditions in the reservoir rock about the wall of the well beyond a distance of three times the well radius, measured from the well axis. The number, form, and pattern of perforations should also be chosen with due consideration of the effects of these variables on the strength of the screen pipe to resist stresses imposed in the well. Tests on slotted pipe, as commonly manufactured for oil-field use, indicate that the tensile and bending strength is over 95% that of the same casing without slots.[3]

Fig. 1 Types of Perforated and Screen Pipe: A—*shop-perforated pipe;* B—*slotted pipe;* C—*wire-wrapped screen pipe;* D—*button screen pipe.*



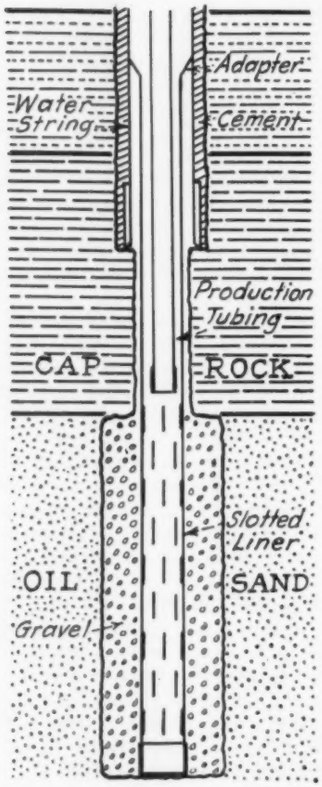


Fig. 2 Illustrating Objective Sought in Gravel Packing by Circulation Methods.

Use of Gravel About Screen Pipe for Sand Control: No type of metallic screening can be completely effective in preventing sand incursion into wells. If the screen openings are sufficiently large so that they do not unduly restrict passage of fluids, they will also pass some of the smaller sand particles. Indeed, some authorities believe that we should not try to exclude all of the fine sand particles; that, by producing some of the fine-grained sand from the formation about the wall of the well, we accumulate a sheath of high-permeability coarse sand grains about the screen openings, which eventually bridge and create a stable barrier. There is good reason to believe that creation of such a barrier about the screen-pipe apertures is a very desirable, even an essential, condition in achieving an optimum restraining influence on influx of loose sand and in promoting maximum production of the formational fluids.

If this reasoning is correct, why should we not resort to placement of coarse sand in the annulus between the screen pipe and the wall of the well as a phase of the well completion program? This is the objective of "gravel packing"—so called because, when first applied, operators made use of relatively coarse gravel as a screening material. Later experience has indicated that, instead of gravel, the screening material should be a coarse sand, the grain size of which is proportioned to the size of the sand grains composing the reservoir rock. Infiltration of reservoir sand into the pore spaces of the "gravel pack" defeats the purpose, and the size of the particles of the screening material must be small enough to serve as a bridge for the reservoir sand. Fig. 2 pictures the objective sought in gravel packing. In conformity with field usage, we shall herein refer to the screening material as "gravel"—though it will be understood that it is, in reality, coarse sand rather than gravel.

Two ways of applying gravel as a screening material in wells have been developed. In one, the gravel is circulated into position around the screen pipe after it has been placed in the well, using drilling fluid or oil as a circulating medium. In the other, prepacked gravel screens are used, in which gravel of suitable size is compacted between two concentric cylindrical metallic screens and shipped to the well in short sections which are fastened together end-to-end at the well head to form a continuous liner which is then lowered into position in the well.

Wells protected with gravel-packed liners generally show consistently larger rates of production, and have fewer interruptions in service, than wells without such protection. Pumping-equipment maintenance costs are considerably reduced.[10]

Forming Gravel Packs by Circulation Methods: Several methods of placing gravel about screen pipe in wells have been developed and successfully used in the field. Irrespective of the method employed, it is first advisable to ream the well through the producing formation to form a cavity about the screen pipe in which gravel may accumulate. A moderate increase in well diameter may be achieved by use of underreamers or wall scrapers. Larger well cavities may be formed by use of explosives or by hydraulic methods described in a later section of this article.

In applying circulation methods to placement of gravel in well cavities, the gravel is slowly added to circulating fluid at or near the well head, so that it becomes entrained in the descending fluid. Suitable arrangement of the well tubing—the perforated liner or screen pipe, auxiliary packers, and valve controls—causes the gravel particles to descend with the circulating fluid through one channel and be deposited in the well cavity, while the circulating fluid without entrained gravel returns to the surface through another channel.

The gravel may be placed by "direct circulation." or by "reverse circulation." With direct circulation, two concentric tubes are suspended in the well just off bottom, and the circulating fluid carrying gravel in suspension is pumped down through the annulus between them (see Fig. 3-A). Gravel is deposited in the well cavity while the outer tube is slowly raised and the circulating fluid returns to the surface through the annulus between the larger tube and the surrounding casing. The smaller column of tubing remains as a permanent part of the well equipment and is later gun-perforated. This method is comparable with the circulation arrangements in a well being drilled by the rotary method, in which the drilling fluid flows down through the drill pipe and returns to the surface through the annular space about it.

In reverse circulation, fluid carrying gravel in suspension flows down through the annulus between a perforated liner and the wall of the well; the gravel is deposited in the cavity about the perforated liner, while circulating fluid returns to the surface through an auxiliary column of tubing inside the liner (see Fig. 3-B). Reverse circulation has been used more than direct circulation. The fluid used is often drilling fluid, though crude oil would appear to be more advantageous.

A more primitive method of forming a gravel pack involves first filling the well cavity with gravel by direct circulation and then rotating the perforated liner—with a suitable shoe or drilling bit on the lower end—down through the accumulated gravel. When the lower end of the liner reaches bottom, gravel left inside the liner is bailed out. This method is not regarded with favor because of the difficulty of keeping the liner centered in the well cavity.

If the hole has been suitably underreamed, the circulation methods leave a well compacted mass of gravel several inches thick and of uniform density about the liner. If gravel of proper size is used, there is little tendency for sand from the producing formation to infiltrate the gravel screen, and little or no formational sand will reach the perforated liner.

Prepacked Gravel Liners: Difficulties experienced with some of the earlier gravel-pack jobs, in which coarse gravel was used as a screening material, led to the development of prepacked gravel-screen liners, in which a relatively thin bed of gravel is confined between a perforated pipe and a concentric outer metallic screen of somewhat larger diameter (see Fig. 4). The gravel is compacted in the annulus between the two metallic screen members in the shop where the screens are assembled; and prepacked sections, several feet long, are shipped to the field and welded or screwed end-to-end at the well head as the liner is lowered into position in the well. The outer screen is relatively light, and may be slotted sheet metal or a heavy woven-wire mesh. The outer screen is supported by metal spacers on the inner perforated pipe, so that an annular space of about ½ in. is left between them. In this the gravel is compacted.

Prepacked liners give assurance of a continuous sheath of well compacted gravel about the liner perforations—with no opportunity for shifting or displacement of the gravel. However, the gravel sheath is comparatively thin in comparison with that provided by the circulated type of pack, and there is more possibility of fine sand finding its way through the gravel pore spaces into the well. Also, the thin walled, outer metal screen may be damaged by scraping on the walls of the well while being installed, and may accumulate clay in its screen apertures which is difficult to remove. The walls of the well will, in time, close in about the outer screen so that the advantage of the

what's the secret

why is Caposite so strong?

It's no secret why CAPOSITE insulation is so strong and stands up to such rough usage. These pipe sections and blocks are made wholly of Amosite asbestos and the long fibres of this particular kind of asbestos give CAPOSITE its strength and resilience as well as its high insulating value.

This exceptional strength leads to many other features besides long life; it means that larger sizes of pipe sections and blocks are possible, making application easier and faster. Less care is needed in handling the material. Unlike other moulded insulation, CAPOSITE, because of its streng..., can be shipped to refineries anywhere in the world *in cardboard cartons*, showing big savings in freight and storage costs.

CAPOSITE regd.

ASBESTOS INSULATION

THE CAPE ASBESTOS COMPANY LIMITED, 114 & 116 PARK STREET, LONDON, W.1. Telephone: Grosvenor 6022. Cables: Incorrupt London

Enquiries in Canada to: Cape Asbestos (Canada) Limited, 200 Bloor Street East, Toronto, Ont.
U.S.A.: North American Asbestos Corporation, Board of Trade Building, Chicago 4, Illinois.

larger-diameter hole is lost. The liner is likely to become "frozen" to the walls, and will be difficult to remove at any future time without damage. Corrosion of the outer screen, under some field conditions, may lead to rapid disintegration and release of the gravel.

Principles Governing Use of Gravel in Sand Control: Laboratory research has confirmed the advantages of gravel-pack completions, and has provided information helpful in selecting suitable gravel sizes.[11] Tests indicate that the gravel particles will form a stable bridge for the formational sand when the size of gravel particles is no greater than 11 times the size of the formational sand grains corresponding to the 10% point on the screen analysis.[18] This means that the gravel must be screened within rather narrow limits—usually 4- to 10-mesh (0.185-in. to 0.065-in.). However, the permeability of the gravel envelope is not seriously impaired if the gravel is as small as 14-mesh (0.046-in.).

The thickness of the gravel envelope should be at least five gravel-grain diameters if a secure bridge is to be formed, and greater thickness gives added security against sand penetration. The permeability of the gravel envelope to fluids will always be considerably greater than that of the surrounding reservoir rock.[14] The permeability of reservoir rocks seldom exceeds 3 darcys, while that of the gravel envelope ranges from 1,150 darcys for closely compacted 8- to 10-mesh gravel to 3,700 darcys for 4- to 6-mesh gravel. Thus, the circulated gravel pack to a considerable degree preserves the superior drainage characteristics of the original well cavity in which it is placed.

Use of Plastics in Consolidating Caving Formations: Formations composed of loose sand which tends to cave into the wells may be consolidated by impregnating the walls of the wells with fluid thermosetting plastic. When the plastic sets and hardens, it serves to bond the sand grains together so that they form a hard, firm rock of the nature of sandstone, which no longer displays caving tendencies. A plastic used for this purpose should have low initial viscosity so that it may permeate the sand pore spaces, and it should set within a reasonable time (2 to 16 hours) at the prevailing temperature in the well at the depth where it is to be used. The liquid plastic, applied under pump pressure, penetrates the sand pores for several inches beyond the wall of the well. When the plastic subsequently polymerizes and hardens, it shrinks to perhaps ⅛ or ½ of its liquid volume—leaving much of the original pore space available for oil and gas drainage, yet cementing the sand grains firmly together.[19-22]

A recently developed improvement in the use of plastics for sand exclusion involves use of crushed and sized (20- to 30-mesh) walnut shells coated with a liquid phenol-formaldehyde plastic, dispersed in a suitable carrying oil. This mixture is forced under pump pressure into the wall of the well through the loose-sand interval and allowed to set and harden before the pump pressure is relieved. The result is a firm and well consolidated wall of maximum residual permeability. Laboratory tests have shown that the well-bonded nut-shell matrix admits fluids freely, while the loose formational sand bridges over the pores of the shell fragments—thus preventing further movement of sand into the well.[20-21]

Development of Well Cavities Within Producing Formations to Improve Production Efficiency: The reservoir rock immediately surrounding the wall of the well is a critical zone in which most of the pressure loss occurs in moving fluids from the reservoir into the well. Here much gas is released from solution in the oil, and the volume of fluid in motion is at a maximum. Theory and experimental evidence indicate that substantially half of the energy expended in moving oil through the drainage radius of a 6-in.-diameter well occurs within 5 ft of the wall of the well. To the extent that we can remove this high-energy-loss zone, we may improve drainage efficiency.

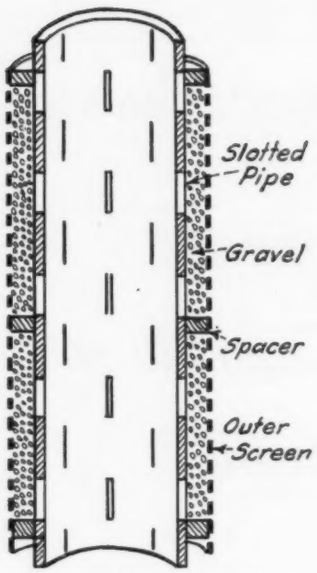
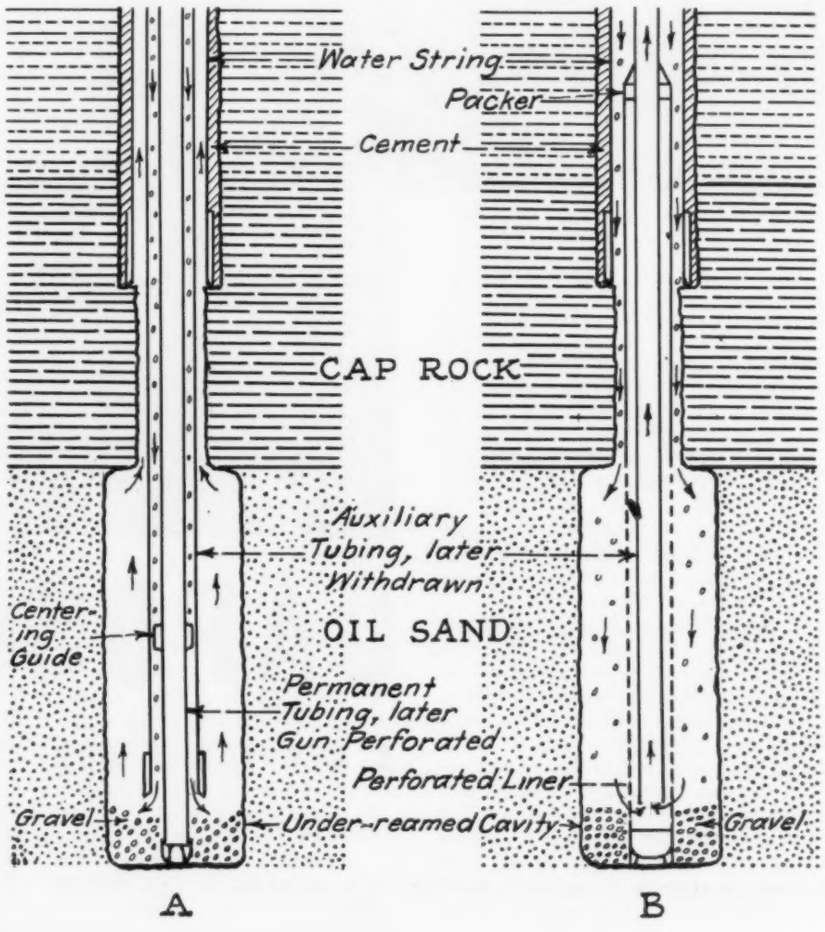


Fig. 4 Prepacked-Gravel Screen Liner.

Fig. 3 Circulation Methods of Gravel Packing: A—*by direct circulation;* B—*by reverse circulation.*



If we could drill a well 10 ft in diameter through the producing formation, theory indicates that it would maintain a rate of production more than twice that of a 6-in.-diameter well. It would develop a much greater drainage radius than the 6-in. well, and would achieve a correspondingly greater ultimate production. We could drain a reservoir effectively with fewer, more widely spaced wells if they could be of large diameter—and development and production costs could be reduced.

Unfortunately, it is impractical to drill wells 10 ft in diameter from the surface; or, if we could, they would be very costly. It is, however, entirely practical to achieve the same result by enlarging the bore of a well of ordinary diameter where it passes through the producing reservoir. This may be accomplished, to a limited extent, by mechanical underreaming; but available mechanical devices suitable for this purpose have practical limitations which normally do not admit of increasing the well diameter by more than a few inches. This would result in only minor increase in production efficiency. Formation of well cavities 5-ft to 10-ft in diameter—which would substantially improve production efficiency—must be accomplished by others means.

Formation of Well Cavities in Hard Formations with High Explosives: For many years, oil producers in some fields have resorted to the use of high explosives in forming well cavities in hard limestones and sandstones; and, under favorable circumstances, cavities several feet in diameter are formed by this means. Nitroglycerin is commonly used for this purpose. Well "shooting" is hazardous, and is ordinarily done by a service organization which undertakes the work under contract, with its own skilled personnel and special equipment. A charge of from 5 qt to 100 qt of nitroglycerin may be used in a single shot, and in some cases a well may be subjected to several successive shots.

The liquid explosive is poured into cylindrical sheet-metal torpedos at the well head, and lowered on a wire line to the depth in the well at which it is to be exploded. Detonation of the explosive is accomplished by a time bomb placed in the charge, by a "go-devil" or squib dropped from the surface, or electrically through a wire circuit connecting an electric blasting cap with a surface source of electricity. The shot is preferably tamped with water or sand to prevent it from expending its energy upward—thus developing a maximum effect horizontally against the wall of the well and the surrounding formation.

The effect of such a shot is a complete shattering of the walls of the well through the producing interval where the explosive charge is placed. Fractures are also formed in the surrounding strata which, it is believed, extend many feet out from the well into the surrounding oil and gas reservoir. If the charge has been tamped with water, there may be an immediate rush of gas, water, and rock débris to the surface—often followed by free flow of oil and gas. If the charge has been tamped with sand, there may be very little surface effect. In either case, the rock débris must be thoroughly bailed from the well cavity.

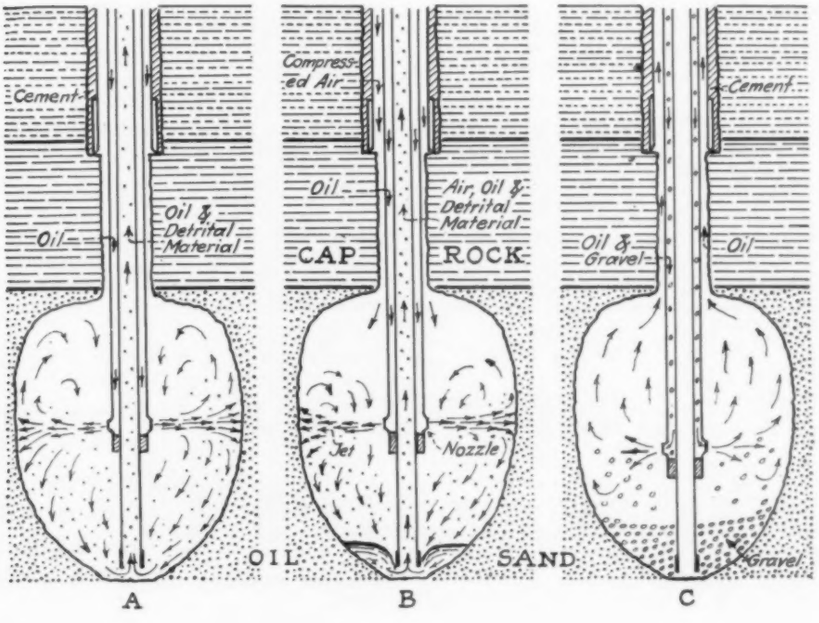
Measured volumes of gravel placed in well cavities formed by explosives have, in some instances, indicated that they are 3 ft or more in diameter. Repeated shooting of wells will produce larger cavities. When it is considered that fractures extending from the walls of the cavity outward into the surrounding formation will materially add to the free drainage surfaces, it is apparent that under favorable conditions, well shooting may greatly increase drainage efficiency. This has been confirmed in thousands of wells in many fields where shooting with nitroglycerin has been commonly practiced as a part of the well-completion procedure.

Formation of Well Cavities in Soft Formations by Hydraulic Jets: In unconsolidated and semiconsolidated formations, where explosives tend to compact rather than shatter the material about the wall of a well, application of hydraulic force may be helpful in forming well cavities. In this method, hydraulic jets direct a circulating fluid against the wall of the well from nozzles in a column of auxiliary tubing. Detrital material loosened by the hydraulic jets is circulated to the surface with the returning fluid in a continuous process; and, when the cavity formed by this means has attained sufficient size, it may be filled with gravel to prevent its walls from caving. A gravel-filled cavity of substantial size—with a perforated liner extending longitudinally through it—becomes a permanent fixture, and serves not only to improve production efficiency, but also to restrain influx of sand to the pumping mechanism.

Hydraulic excavation of well cavities has, as yet, been little used in the petroleum-producing industry—though the method would appear to offer promise of favorable results under suitable conditions. Use of hydraulic force as a means of forming well cavities was first suggested by the writer in 1924; and subsequently, in published articles, the results of laboratory research were offered which have conclusively established the advantages of gravel-filled cavities as a means of promoting production efficiency.[27,28,29] From the field has come evidence that wells so equipped have higher production rates, and produce with lower gas-oil ratios—which is regarded as promise of increased ultimate recovery. Experience of water-well drillers, who commonly provide gravel envelopes about producing wells, also confirms the advantages of the method.

Various procedures are possible in applying the hydraulic method of excavating well cavities. The writer has proposed a method in which a fluid (oil or drilling fluid) is pumped under high pressure down the well through tubing and jetted against the wall of the well through nozzles placed near the lower end of the tubing. Two telescoped strings of tubing are employed (see Fig. 5-A), so arranged that the inner tube remains stationary with its open lower end near the bottom of the well; while the outer column of tubing, in which one or more nozzles have been provided, can be raised or lowered and turned. A packer closes the annulus between the two tubes at the lower end of the outer tube just below the nozzles, and is so adjusted that the packer may slide freely over the inner tube—which is of

Fig. 5 Illustrating Proposed Hydraulic Method of Developing Gravel-filled Cavities: A—excavating cavity with hydraulic jets; B—excavating cavity with hydraulic jets aided by air lift; C—circulating gravel into cavity.



flush-jointed construction (without collars) with a smooth exterior surface.

Oil or mud fluid is pumped down through the annulus between the two concentric tubes and is jetted horizontally, directly against the wall of the well. The fluid circulates back to the surface through the inner tube—carrying with it the detrital material excavated from the walls of the well by the jets. The outer tube is raised, lowered, and turned so that the fluid jets are applied at all levels in the well in the interval where the cavity is to be formed. While the jets must operate through the intervening fluid, a powerful erosive effect on the nearby wall of the well is, nevertheless, developed—sufficient, it is believed, to excavate sand strata at a distance of several feet from the jet nozzles. Use of compressed air, operating as a gas lift through the inner tubing, may maintain a fluid level in the well cavity below that of the jets—thus further promoting the erosional effect and expediting removal of detrital material (see Fig. 5-B).

Fluid pressure in the well supports the walls of the cavity while excavation is in progress. When excavation is completed, the cavity may be filled with gravel, using the same telescoped-tubing installation (see Fig. 5-C). Circulation of fluid continues under reduced pressure while gravel is slowly fed into the descending stream from surface tanks and jetted outward through the nozzles into the well cavity. Fluid returns to the surface, either through the inner tube or through the annulus between the outer tube and the surrounding well casing. Starting near bottom, the outer tube is slowly raised as gravel accumulates in the well cavity. Ascending fluid velocities are insufficient to raise the gravel particles. When the cavity has been filled with gravel, the outer tube is removed while the inner tube may be gun-perforated and left permanently in the well to serve as an eduction tube for free-flowing or gas-lifting production.

Using the method described, a water-well drilling contractor has been able to place as much as 90 cu yd of gravel in a well cavity.

Increasing drainage surfaces in wells by drilling "drain holes": As explained in an earlier section of this article, a vertical well drilled through a gently dipping oil- and gas-producing formation offers but limited wall area through which fluids may enter the well. For many years, production technologists have suggested that, if by some means, the well could be deflected from its vertical course after entering the oil and gas reservoir, so that it would follow the dip of the producing formation or continue laterally along its strike, much larger drainage surfaces could be developed and presumably production of oil and gas would be correspondingly increased. Within very recent years, methods have been developed for accomplishing this.[30, 33]

With special rotary-drilling equipment now available, it is possible to drill several holes in different directions and at any desired declination from a vertical well drilled from the surface. Such branch holes may extend for as much as 100 ft from the axis of the main bore and be entirely within the oil- and gas-producing formation—thus adding hundreds of square feet of wall space for additional drainage of oil and gas. These branch wells have been called "drain holes," and reflection will show that they have much the same effect in promoting drainage efficiency as the well cavities described in the preceding section.

The equipment employed in drain-hole drilling is a development of the art of directional drilling. The well is drilled with rotary equipment as a vertical hole in the conventional way, and a liner is set through the full thickness of the reservoir. A special assembly is then attached to the lower end of the drill column, comprising a preformed nonrotating curved guide tube and an inner flexible rotating drive tube on the lower end of which a drilling bit is attached. The drilling assembly is positioned in the well at the depth selected for departure, with the curved tube oriented in the desired direction. An oriented whipstock may be set in the well if desired, instead of the curved tube. Rotation of the drill column and application of suitable weight then causes drilled hole—penetrating the liner and following a curved path determined by the curvature of the fixed tube and the bit pressure applied. Several such holes may be drilled in different directions, and at different depths, in the same well. Slotted liners may be installed in the drain holes—thus holding them open for drainage and restricting sand incursion.

The third and concluding article of this series, which will appear in an early issue of WORLD PETROLEUM, will deal with methods for increasing the permeability of reservoir rocks in the vicinity of producing wells. Following is a brief selected bibliography of authoritative references on the topics discussed in the present article.

SELECTED BIBLIOGRAPHY

On use of screen pipe in sand exclusion:

1. Cabeen, W. R., and Bemis, E. G., "Field Performance of Sand-Control Liners in California," *API Drilling and Production Practice* p. 271-301 (1949).
2. Chenault, R. L., "Experiments on Fluid Capacity and Plugging of Oil-well Screens," *API Drilling and Production Practice*, p. 296-306 (1938).
3. Coberly, C. J., "Selection of Screen Openings for Unconsolidated Sands," *API Drilling and Production Practice*, p. 189-201 (1937).
4. Cunningham, J. M., "Theoretical Consideration of the Perforation Pattern in a Screen Pipe," *API Drilling and Production Practice*, p. 307-321 (1938).
5. Howard, R. A., and Watson, M. S., Jr., "Relative Productivity of Perforated Casing," *AIME Petroleum Development and Production*, p. 179-182, 323-324 (1950).
6. Miller, A., "Liners, Perforated and Screen Pipe," *Journal Inst. Petrol. Tech.* (London) p. 34-50 (Jan. 1934).
7. Miller, F. G., "Pressure Distribution about a Slotted Liner in a Producing Well," *AIME Petroleum Development and Technology*, p. 137-151 (1941).
8. Muskat, M., "Effect of Casing Perforations on Well Productivity," *AIME Petroleum Development and Technology*, p. 175-187 (1943).
9. Wilson, G. S., "Selection and Use of Screen Pipe," *AIME Petroleum Development and Technology*, p. 116-135 (1933).

On gravel packing for sand exclusion:

10. Clark, W. A., "Economics of Gravel Packing in California," *API Drilling and Production Practice*, p. 327-332 (1939). See also "A Résumé of the Application of Gravel Packing in California," *AIME Petroleum Development and Technology* p. 15-24 (1940).
11. Coberly, C. J., and Wagner, E. M., "Some Consideration in the Selection and Installation of Gravel Pack for Oil Wells, *AIME Paper No. 960* (Aug. 1938).
12. Garten, J. P., "An Investigation of the Production Characteristics of Wells Completed with Gravel-Screen Liners," *AIME Paper No. 683-G* (Oct. 1956).
13. Gumpertz, B., "Screening Effect of Gravel on Unconsolidated Sands," *AIME Petroleum Development and Technology*, p. 76-85 (1941).
14. Hill, K. E., "Factors Affecting Use of Gravel in Oil Wells," *API Drilling and Production Practice*, p. 134-143 (1941).
15. Rodgers, C. J., "Some Aspects of Gravel Packing," *AIME Trans.*, vol. 201, p. 15-21 (1954).
16. Sage, B. H., and Lacey, W. N., "Effectiveness of Gravel Screens," *AIME Petroleum Development and Technology*, p. 89-106 (1942).
17. West, T. S., "A New-Well-Completion Technique," *AIME Petroleum Development and Technology*, p. 250-266 (1947). See also "A Gravel-Pack Completion for Exclusion of Gas and Water," *AIME Trans.*, vol. 192, p. 183-190 (1951).
18. Winterburn, "Application of Gravel Packing to Unconsolidated Sands," *Oil Weekly*, Jan. 11, 1943, and Jan. 18, 1943. See also "Control of Unconsolidated Sands in Wilmington Oil Field," *API Drilling and Production Practice*, p. 63-73 (1947).

On use of plastics in sand control:

19. Cardwell, P. H., "Plastic Used to Consolidate Incompetent Formations," *AIME Petroleum Development and Technology*, p. 174-179 (1947).
20. Henderson, J. K., Sallee, W. L., and Stout, C. M., "How Plastic-coated Walnut Shells Control Loose Sands," *World Oil*, April 1956, p. 271-276 (AIME paper).
21. Ladd, B. J., and Terrell, K. E., "Newest Method to Control Unconsolidated Sands," *Petroleum Engineer*, December 1955, p. B-112-117.
22. Smith, R. H., and Polk, A. C., Jr., "Use of Plastics in Consolidating Loose Sand in Wells," *AIME Petroleum Development and Technology*, p. 243-249 (1947).

On use of explosives in forming well cavities:

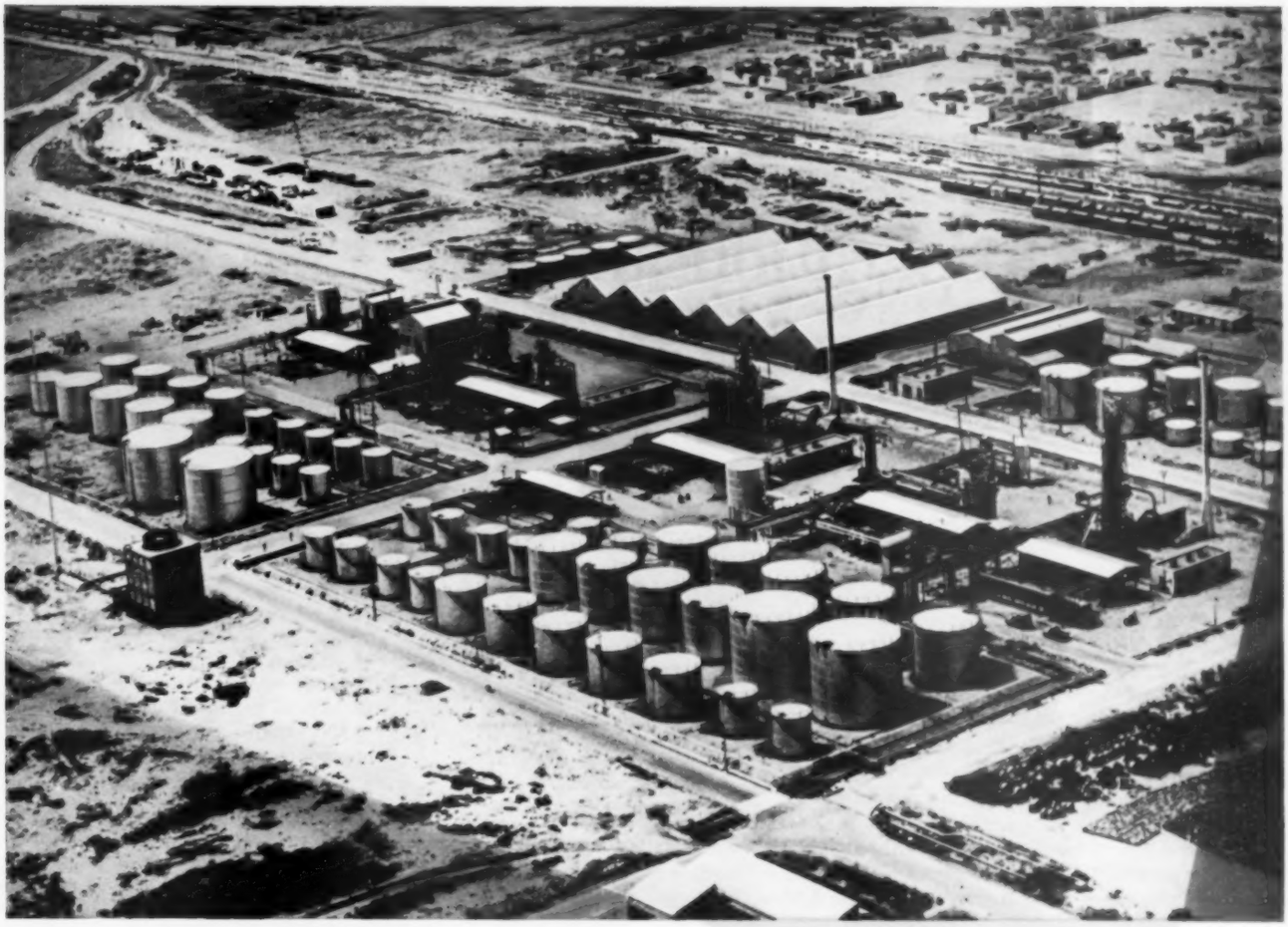
23. Atchison, T. C., Jr., Grant, B. F., and Duvall, W. I., "Progress Report on Well-Shooting Research," *API Drilling and Production Practice*, p. 63-72 (1952).
24. Evinger, H. H., and Muskat, M., "Some Theoretical Considerations on the Problem of Well Shooting," *AIME Petroleum Development and Technology*, p. 216-231 (1941).
25. Grant, B. F., Duvall, W. I., Obert, L., Rough, R. L., and Atchison, T. C., "Research on Shooting Oil and Gas Wells," *API Drilling and Production Practice*, p. 303-311 (1950).
26. Lewis, P. F., "Oil-Field Explosives—Their Characteristics and Use," *API Drilling and Production Practice*, p. 73-88 (1934). See also "The How and Why of Well Shooting," *API Drilling and Production Practice*, p. 278-284 (1938).

On the influence of well diameter and use of jets in forming well cavities:

27. Uren, L. C., "Increasing Production of Petroleum by Increasing the Diameter of Wells," *AIME Trans.*, vol. 71, p. 1276-1300 (1925).
28. Uren, L. C., "Sand Control in Oil Production," *The Petroleum Engineer*, April 1934, p. 20-23.
29. Uren, L. C., Domercq, J., Jr., and Mejia, J., "Influence of Well Diameter upon the Pressure Gradient and Rate of Flow of Oil Through the Reservoir Rock in the Vicinity of a High-Pressure Flowing Well," *AIME Petroleum Development and Technology*, p. 11-24 (1935).

On drain-hole drilling:

30. Eastman, H. J., "Lateral Drain-Hole Drilling," *The Petroleum Engineer*, Nov. 1954, p. B-57-73, and Dec. 1954, p. B-44-47.
31. Perrine, R. L., "Well Productivity Increase from Drain-Holes as Measured by Model Studies, *AIME Journal Petroleum Technology*, p. 30 (Feb. 1955).
32. Stormont, D. H., "Increasing Drainage of Oil into Wells by Drain-Hole Drilling," *Oil & Gas Journal*, Aug. 17, 1953, p. 105-108, 145. See also *ibid.*, Oct. 11, 1954, p. 144-146.
33. Zublin, C. W., "The Theory, Application and Mechanics of Drain-Hole Drilling," *AIME Journal Petroleum Technology*, Oct. 1954 *(Tech. Paper 446-G)*.



lube oils for IRAQ

New 25,000 ton/year plant
completed by Foster Wheeler in 24 months

Recently completed for the Government of Iraq, this new plant near Baghdad provides the most modern facilities for producing a full range of lubricating oils. Designed and built from the ground up by Foster Wheeler, Ltd., London, with materials purchased from European sources, it includes vacuum distillation, propane deasphalting, furfural solvent refining, propane dewaxing, clay percolation, asphalt oxidation and blending facilities, as well as the steam and power plant, storage tanks and modern equipment for can and drum manufacture, compounding and filling.

Despite transportation delays due to Middle-East political complications, the plant was completed and on stream *on schedule* — just 24 months from award of contract.

Foster Wheeler has also been awarded a contract for a major modernization program of the gasoline-fuel oil section of this refinery — including expansion of existing combination unit, installation of new Powerforming and kerosene treating units and substantial offsite facilities.

FOSTER WHEELER

NEW YORK • LONDON • PARIS • ST. CATHARINES, ONT.

REVIEW OF RECENT USA PATENTS ON PETROCHEMICALS

Preparation and reactions of olefins

by Heinz Heinemann and Harold Shalit

This patent review on petrochemicals is concerned with olefins, their preparation, purification and their reactions other than polymerization, which will be separately reviewed at a later date. The present subject was last treated in June 1956, at which time some forty patents were discussed. The growth of the field and of interest in it is evidenced by the fifty-six patents selected for this new review because of their general interest, out of a much larger number of patents which have been issued in the interim.

The increase in the number of patents issued in this field reflects the importance of olefins both as chemical raw materials and as finished products. Petroleum hydrocarbons constitute the largest potential source of unsaturated compounds. Development of efficient, selective dehydrogenation processes for the conversion of saturated to olefinic hydrocarbons greatly augments the availability of olefinic materials. Most consumer products manufactured by the organic chemical industry are or can be based on petrochemical olefins, accounting for the variety of olefin reactions, which have been patented and which are reviewed here.

Formation of Olefins

Several methods are available for the production of olefins; of these dehydrogenation is currently receiving some attention. In 2,719,171, G. H. Kalb of the du Pont Co. proposes to dehydrogenate a class of compounds having ethyl or isopropyl groups attached to a carbon atom which shares a double bond with another atom. The reaction is carried out by heating the compound in the vapor phase at 450°-800° C. with oxygen in the presence of iodine. Shell Development Co. in 2,765,355 (K. Nozaki) suggests a method for producing methylcyclopentene. Methylcyclopentane is dehydrogenated at 400°-600° C. with a catalyst comprising 0.05%-0.5% platinum on an alumina-free silica gel. Pressures are around 30 psig, hydrogen is charged, and the space rate is controlled so that methylcyclopentene in the product is less than 90% of equilibrium. It is claimed that this allows manufacture of methylcyclopentene from readily available materials, gives improved yields, produces less by-products, and allows easier recovery of reaction product. In 2,755,321 (R. L. Hasche of Koppers Co., Inc.) there is proposed an apparatus for thermal dehydrogenation of paraffins in which the endothermic heat of dehydrogenation is supplied by partial combustion of the charge gases.

Some miscellaneous olefin producing reactions will now be considered. F. R. Rust and L. M. Porter (2,755,322 to Shell Development Co.) prepared compounds containing at least one allylic group by decomposing an allyl halide above 450° C. The decomposition should be of short duration and should take place in the presence of an excess of a hydrocarbon containing at least one replaceable hydrogen atom. Thus, for example, allyl chloride and propane react to form hexene-1. In 2,768,225 (O. K. Moore to California Research Corporation) a method is proposed for making long chain olefins containing 10-18 carbon atoms by cracking petroleum wax over activated gamma alumina under conventional cracking conditions at temperatures below 1100° F. Olefins containing at least one naphthene ring per molecule are produced by L. Schmerling in 2,769,849, assigned to U. O. P. The process consists of reacting a mixture of ethylene, cycloparaffin, and an organic peroxide catalyst at temperatures at least as high as the initial decomposition point of the catalyst and at pressures above 15 atmospheres.

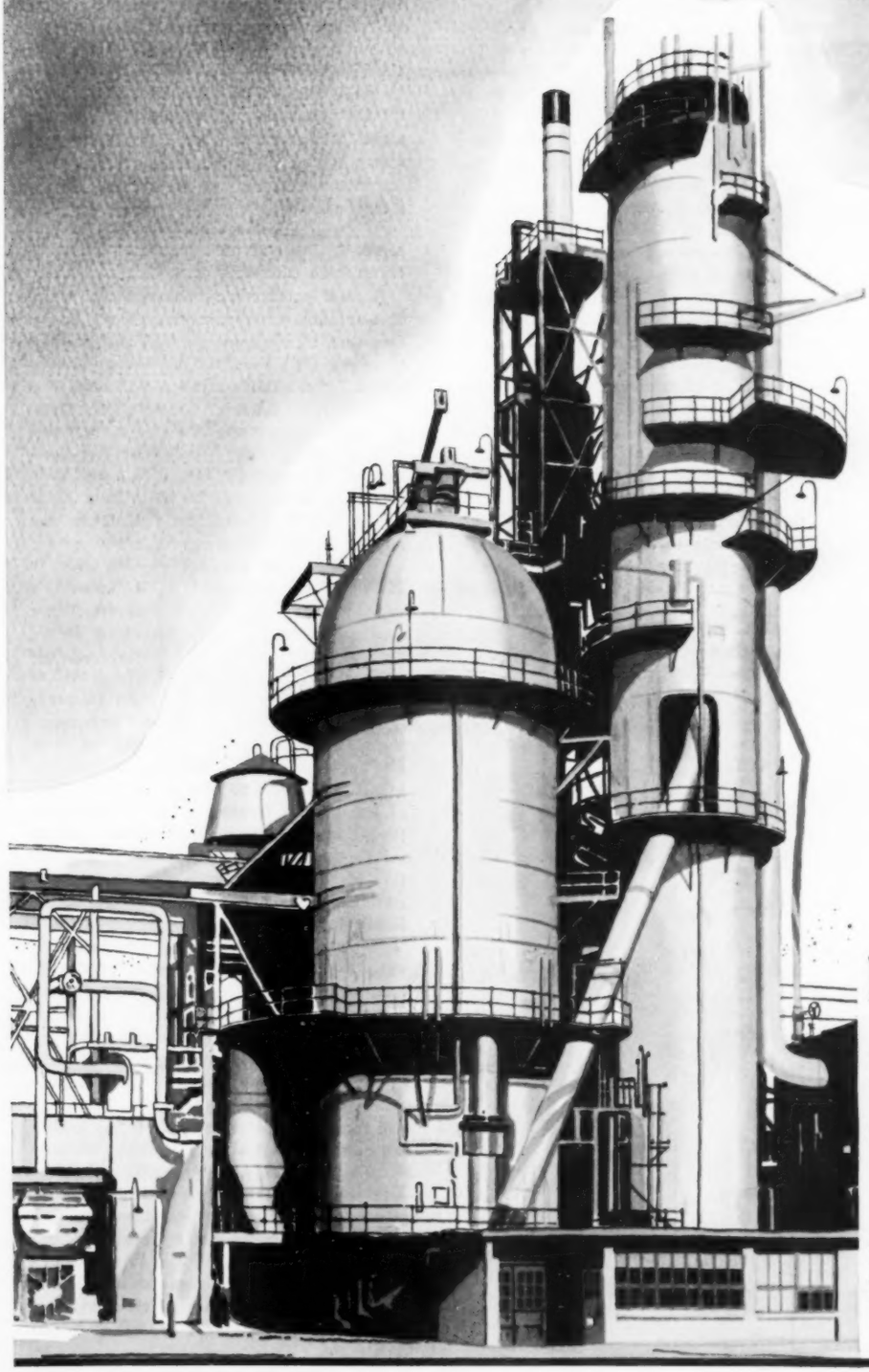
Separation and Purification of Olefins.

For many of their uses olefins must be separated from other materials or purified of contaminants. The following patents deal with methods for accomplishing such separations. R. H. Johnston and G. E. Mitchell (2,745,889 to Esso Research and Engineering Co.) propose to separate ethylene, propylene, and butenes from cracked naphthas by a combination of fractionation and absorption. A product from high temperature cracking is fractionated so that the overhead contains the desired olefinic cut. This overhead material is then contacted with an absorber oil heavier than butanes, which oil removes the bulk of the propylenes and butylenes. The unabsorbed ethylene fraction is contacted with a light gas oil from the primary fractionation to remove any remaining heavy olefins.

In 2,753,381 (to Phillips Petroleum Co.) W. T. Nelson proposes the use of N-acylpyrolidines as selective solvents for extracting olefins (also naphthenes and aromatics) from paraffins.

Oxo products contain aldehydes and olefins; it is frequently desired to hydrogenate the aldehydes to alcohols without, at the same time, saturating the olefins. B. H. Gwynn (2,760,994 to Gulf Research and Development Co.) accomplishes this by carrying out the hydrogenation in the presence of water at ratios of 0.15 to 2 volumes of water per volume of mixture. The reaction takes place at temperatures from 300°-500° F. over a low temperature hydrogenation catalyst such as nickel-tungsten sulfide, copper chromite, or cobalt molybdate. In 2,775,637, W. C. Lanning and R. J.

True satisfaction in building comes only with the finished job



Here at Procon we take a lot of satisfaction in all phases of our work as builders. Everything we do, from designing and engineering through each stage of construction, gives us that feeling of accomplishment which is so rewarding a part of any job well done.

We only get our fullest measure of satisfaction, though, when the job is finished, faithfully done to every requirement of specification and time.

Procon's experienced organization plans and builds refineries, petrochemical and chemical plants anywhere in the free world. You can count on any project you trust to Procon being completed to your true measure of satisfaction, too.

PROCON *Incorporated*

1111 MT. PROSPECT ROAD, DES PLAINES, ILLINOIS, U.S.A.

PROCON (CANADA) LIMITED, TORONTO 18, ONTARIO, CANADA
PROCON (GREAT BRITAIN) LIMITED, LONDON, W. C. 2, ENGLAND
PROCON INTERNATIONAL S. A., SANTIAGO DE CUBA

WORLD-WIDE CONSTRUCTION FOR THE PETROLEUM, PETROCHEMICAL, AND CHEMICAL INDUSTRIES

Procon has just completed construction of this 20,000 bbls. per stream day UOP Fluid Catalytic Cracking Unit for Ashland Oil & Refining Company at Catlettsburg, Kentucky.

Hogan of the Phillips Petroleum Co. suggest the selective removal of carbon monoxide from olefin streams by contacting the stream above 300° F. with an alkalized iron oxide-chromium oxide catalyst which has been reduced with hydrogen.

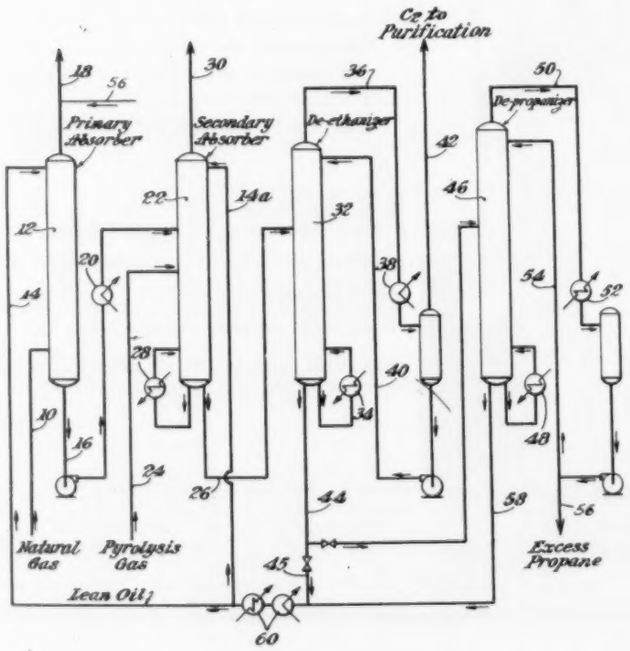
J. C. Hunt, S. E. Jaros, J. F. Nelson (2,771,497 to Esso Research and Engineering Co.) patent a method for removing methyl mercaptan from isobutylene. Isobutylene for use in polymerization must be free of mercaptan, but the material obtained by conventional sulfuric acid absorption techniques contains some methyl mercaptan. The purification process proposed here involves distillation of the impure isobutylene from acid absorption in order to remove overhead a methyl mercaptan-isobutylene azeotrope and leaving, as bottoms, pure isobutylene. The azeotrope is recycled to the acid absorption step.

Chemical Reactions of Olefins

One of the most useful olefin reactions is that of hydration to alcohols. The next group of patent deals with inventions related to olefin hydration. In 2,751,420 (D. W. Huebner to Imperial Chemical Industries, Ltd.) a method is disclosed for the hydration with tungsten oxide in which the olefin is passed through a number of alternate catalyst hydration zones and scrubbing zones. Water is used in the scrubbing zones; a substantial, minor portion of this water passes to the subsequent catalyst hydration zone; while the rest is passed to the next scrubbing zone. In another Imperial Chemical Industries patent (2,755,309 by P. W. Reynolds and L. R. Pittwell) olefins with 2-4 carbons are hydrated to the corresponding alcohols at 160°-350° C. and 200-500 atmospheres in the presence of a catalyst comprising an intimate mixture of blue tungsten oxide and titanium oxide. H. J. Hagemeyer, Jr. and W. J. Clegg (2,763,697 to Eastman Kodak Co.) produce ethyl alcohol by direct vapor phase hydration of ethylene at 250°-325° C. and 50-200 atmospheres over a catalyst containing from 5-30% of copper fluoborate on a porous carrier. A mixture of titania and ferric oxide is claimed as an olefin hydration catalyst in 2,769,847 (R. L. Robinson to Imperial Chemical Industries, Ltd.). This mixture should contain between 1-90 moles ferric oxide per 100 moles.

The sulfuric acid catalyzed hydration of ethylene is the subject of the next two patents. B. I. Smith and W. H. Rader (2,755,297 to Esso Research and Engineering Co.) propose to maintain a high rate of ethylene absorption in sulfuric acid by adding additional acid to the mixture after a maximum rate of absorption has been reached and then contacting this mixture with more olefin. Again, B. I. Smith in 2,765,347 suggests an improvement in the hydrolysis of ethyl sulfate formed by absorbing ethylene in 95% sulfuric acid. In such hydrolyses it is necessary to dilute the acid mixture, maintaining the temperature below 80-90° C. to minimize ether formation. This is accomplished, according to this patent by cooling the acid solution of ethyl sulfate to 30°-50° C. then partly diluting the mixture to 85-90% sulfuric acid, cooling again to 30°-50° C., and hydrolyzing by dilution to an acid strength of 60%.

US Patent 2,780,580: L. Kniel, "Production of Ethylene."



Addition of the elements of hydro-halide acids across a double bond has been studied extensively. In 2,739,990, H. R. Chipman of the U. S. Rubber Co. proposes to add HCl to tertiary olefins containing 5-12 carbon atoms. This reaction is carried out in the presence of 1-10% of an alkyl aryl sulfonic acid catalyst, said alkyl group containing 10-16 carbon atoms. J. F. Kobler, Jr., G. T. Mercies, Jr., and R. G. Sterling (2,786,875 to the Ethyl Corp.) patent an improvement to the process of hydrochlorinating ethylene in the liquid phase with $AlCl_3$ as catalyst. The improvement comprises the addition to the reaction mixture of CO_2 and acetylene in proportions of 0.5-2 volumes of CO_2 and 0.1-1.5 volumes of acetylene per 100 volumes of ethylene. It is claimed that catalyst consumption is minimized. D. K. Barnes of the Pan American Petroleum Corp. in 2,790,013 claims the abnormal addition of HBr to terminal olefins by contacting the gaseous mixture with activated carbon at temperatures from 175°-350° C.

Several patents are devoted to the addition of halogen to olefins. In 2,746,999 (A. A. Gunkler, D. E. Lake, B. C. Potts of Dow Chemical Co.) a continuous method is provided for reacting olefins and ormine at a uniform rate. The invention comprises using as reaction medium the olefin bromide product and performing the addition in a number of reaction zones. In the first zone a solution of bromide in olefin bromide is contacted with a deficiency of olefin so that all the olefin is consumed; in the second zone the product is contacted with olefin to consume all the bromine. C. H. Neher (2,765,353 to Ethyl Corp.) reduces the corrosion encountered in steel equipment during chlorination of olefins. This method consists in distributing concentrated sulfuric acid of at least 70% concentration within the reaction medium (olefin dichloride) in proportions of 0.5-5.0 parts by weight for each 100 parts of olefin dichloride. In 2,785,207 (R. R. Chambers to Sinclair Refining Co.) di-isobutylene (mainly 2,4,4-trimethylpentene-1 is chlorinated to a mixture rich in the β,γ-unsaturated monochloride by reaction in vapor phase with chlorine at 100°-200° C., using a substantial excess of di-isobutylene.

The next two patents deal with reactions closely related to halogenation of double bonds. G. W. Ayers and W. L. Fierce of the Pure Oil Co. in 2,780,638 make saturated dinitriles by reacting olefins with cyanogen over a catalytic metal surface at about 1500° F. Suitable metals include nickel, chromium, iron, manganese, cobalt, platinum, and their alloys. R. Knaus (2,769,845 to Olin Mathieson Chemical Corp.) claims the production of a concentrated olefin chlorohydrin solution from concentrated olefin streams and dilute, aqueous hypochlorus acid. This is accomplished by conducting the reaction in a series of gas-liquid stages where the olefin rich gas and liquid flow counter-currently and the reaction liquor is scrubbed between stages to remove olefin dichloride.

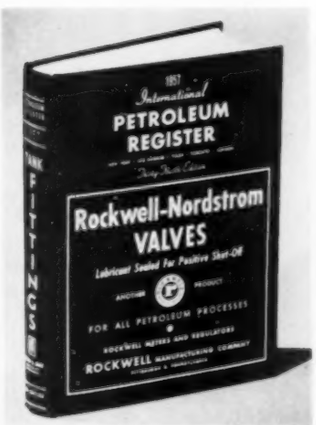
A further extension of the chlorinating

Oil's "BLUE BOOK"

THE INTERNATIONAL PETROLEUM REGISTER

34th Edition is now off the press

●Over 33,000 firms and partnerships engaged in the international petroleum industry . . . . . all in ONE book, alphabetized and indexed.



- Now nearly 40 years old—by far the first and still the leader in its field—covering the world with many thousands of listings, including names of officers, address, description of operations, etc.
- In addition to the handy alphabetical list of companies and individuals which forms a world-wide index for ready reference, the International Petroleum Register offers a breakdown both by company function—producer, pipeline, refiner, petrochemical, etc. and by geographical location.
- This 600-page compendium is low priced at $25. It contains data available only at costs many times as high from piecemeal lists purchased separately.

International Petroleum Register
Order Department
604 Fifth Avenue
New York 20, New York

Gentlemen:

I wish to receive a copy of the new edition of the Register. Please send it to my address below:

Name _____

Company _____

Address _____

(Sale price $25 per copy. Add 3% sales tax for deliveries within New York City).

reaction is the addition of chlorinated compounds across a double bond. In 2,741,642 (H. K. Wiese to Esso Research and Engineering Co.) ethylene is reacted with a 1,3-dichloro alkane in which one chlorine is primary and one tertiary. The reaction takes place in the presence of a Friedel-Crafts catalyst at from −30° to 100° C., and produces 1,5-primary dichloroalkanes. A. W. Anderson (2,769,848 to E. I. du Pont Co.) makes 3,3-dimethyl-1,5 dichloropentane by reacting ethylene with 2,2-dichloropropane in the presence of $AlCl_3$. Telomerization of ethylene with CCl_4 is improved according to 2,770,661 (T. Horlenko, F. B. Marcotte, O. V. Luke of Celanese Corp. of America). Better control of the reaction rate can be obtained by presaturating the CCl_4 with oxygen, purging with an inert gas to remove a portion of the oxygen, and then effecting the reaction.

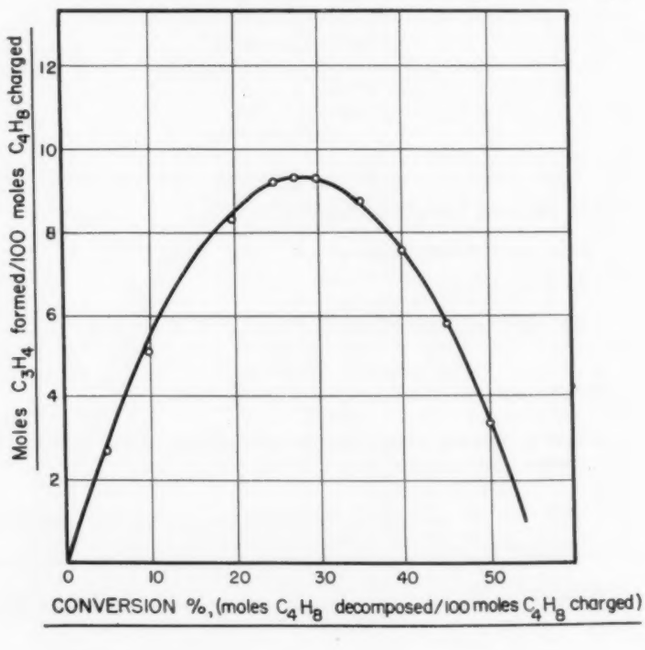
Alkylation of tertiary paraffins or aromatic compounds is an important reaction of olefins. T. J. Peters of the Esso Research and Engineering Co. in 2,739,172 patents a continuous process for the alkylation of phenols with olefins having 6-16 carbon atoms. The catalyst used is BF_3. A separate stream of premixed feed containing phenol and olefin is introduced into the reaction zone. The BF_3 is continuously introduced as a separate stream in amounts from 0.0-1.5 weight percent of phenol. Temperatures are maintained at 50°-100° C., residence times from 10-90 minutes, and products are continuously withdrawn. In 2,767,230 (H. C. Brown and W. S. Higley to Standard Oil Co. of Indiana) phosphorus penta-fluoride is proposed as a catalyst for aromatic alkylation with olefins containing at least three carbons. Compounds decomposing into the pentafluoride may also be used, e.g. benzene diazonium fluorophosphate. R. D. Closson, A. J. Kolka, and W. B. Ligett of the Ethyl Corp. (2,769,850) use olefins to alkylate carbocyclic compounds containing a saturated, hydrogen bearing carbon atom adjacent to a nuclear carbon atom. The reaction is conducted at 200°-375° C., 20-3000 atmospheres and in the presence of an alkali metal hydride catalyst. In 2,768,982, M. J. Schlatter of the California Research Corp. proposes to make α-hydrindacenes by combined alkylation and hydrogen transfer reactions carried out between a para dialkyl benzene (in which the alkyl groups are secondary) and at least two moles of a branched chain olefin. The reaction is carried out in the presence of an acidic catalyst at from −30°-125° C. and from atmospheric to 50 atmospheres pressure. H. Pines and J. A. Vesely (2,771,495 to Universal Oil Products) claim a process for dehydroalkylation using olefins. The specific type of compound alkylated is an unsaturated, six-membered cyclic saturated hydrocarbon containing no geminal carbon atoms, and having at least two double bonds per molecule, one of which is in the ring. The compound must also have at least one alkyl or alkenyl substituent. Alkylation is carried out in the presence of alkali metal or hydride under hydrogen transfer conditions.

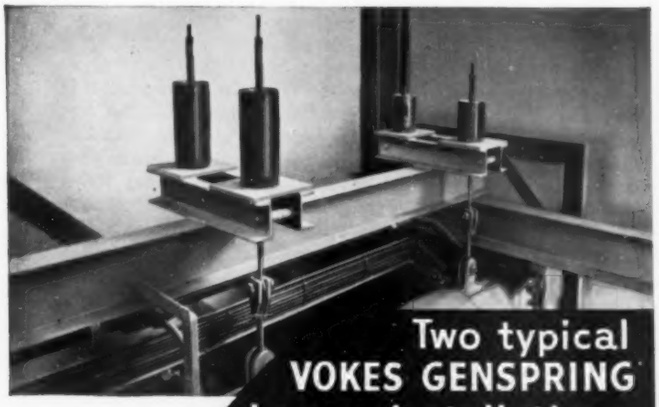
H. M. Hart (2,768,987 to Standard Oil Co. of Indiana) claims an improved cascade type reactor for performing sulfuric acid catalyzed alkylations of olefins and tertiary paraffins. R. D. Closson, A. J. Kolka, and W. B. Ligett in 2,751,426, assigned to the Ethyl Corp, react ethylene with olefins containing at least one allylic hydrogen in the presence of an organo-alkali metal catalyst. The product is an olefin in which the allylic hydrogen of the original olefin has been replaced by an ethyl group. The reaction is carried out in an oxygen free atmosphere, in the presence of 0.01-10 weight percent of catalyst, at temperatures from 100°-182° C., and pressures from 34-46 atmospheres.

The alkylation of basic nitrogen compounds is the subject of several patents. In 2,750,384 (R. D. Closson, A. J. Kolka, and W. B. Ligett to the Ethyl Corp.) an alkylated pyridine, containing hydrogen on the χ-carbon of the substituent group, is alkylated on this χ-carbon with olefins containing up to twelve carbons. Catalysts used are alkali metals or hydrides thereof at temperatures from 50°-350° C. and pressures from 10-2000 atmospheres. These same inventors in 2,750,417 claim the alkylation of amines on the nitrogen atom using olefins as alkylating agent and amides of alkali or alkali earth metals as catalysts. The amides should be derivatives of ammonia compounds not more acidic than the amine in question. R. Stroh, J. Ebersberger, and H. Haberland (2,762,845 to Farbenfabriken Bayer, Akt.) claim the nuclear alkylation of aromatic amines with olefins by heating the reactants to 200°-400° C. in the presence of aluminum metal. The catalyst may be in the form of an alloy or a compound which decomposes under reaction conditions to form the metal. W. H. Urry (2,772,271 to Commercial Solvents Corporation) proposes alkylation of the χ-carbon atom of amines with olefins in the presence of light or alkyl peroxides.

Epoxidation of olefins is another reaction which has recently attained great commercial significance and several patents are devoted to this subject. A. F. Millidge and W. Webster (2,741,623) epoxidize olefins containing three or more carbons by reacting them with oxygen in the presence of an oxidizing catalyst comprising one of the organic salts of copper, manganese, vanadium, or cobalt. The temperature is maintained between 100°-180° C. at superatmospheric pressures. The reactor effluent is treated to remove acidic products part of which are recycled to the reactor. In 2,745,-848 (F. P. Greenspan and R. J. Gall to the Food Machinery and Chemical Corp.) cyclohexene oxide is made from cyclohexene by stirring the olefin with a minor excess of perpropionic acid at 5°-20° C. for 2-4 hours at a pH of 7. In a process for making epoxies from olefins, B. Phillips and P. S. Staicher (2,785,185 to Union Carbide and Carbon Corp.) react acetaldehyde or propionaldehyde with oxygen at less than 15° C. to form tne aldehyde mono-peracylate. This is then reacted with an olefin containing more than three carbons at 25°-200° C. in the liquid phase. C. W. Smith and G. B. Payne (2,786,-854 to Shell Development Co.) prepare epoxies by reacting olefins containing up to twenty-seven carbons with hydrogen peroxidein a non-acid solvent and in the presence of a per-acid of tungsten, vanadium, or molybdenum. Temperatures are maintained below 100° C.; also, the catalyst is

US Patent 2,763,703: J. Happel, "Cracking of Isobutylene with Steam to Produce Substituted Acetylenes and Diolefins."

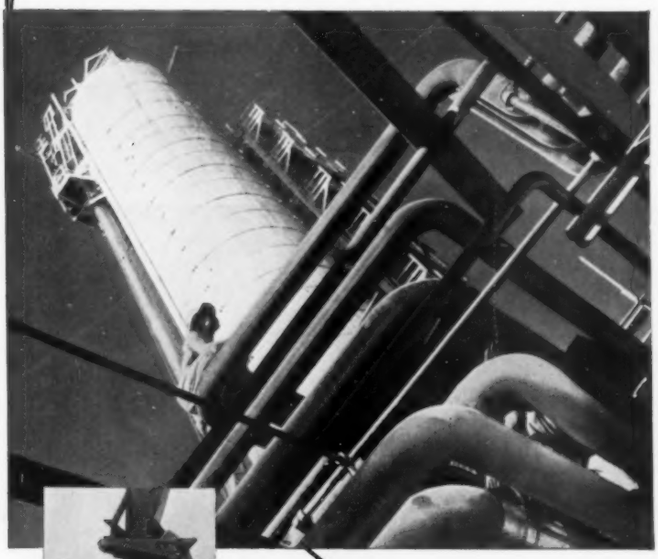




Two typical VOKES GENSPRING hanger installations in the oil industry

Photograph by courtesy of The Associated Ethyl Company Limited.

IN ADEN, The British Petroleum Company's new refinery came on stream in July 1954. Many sections of this complicated process plant piping demand the finest and most accurate suspension methods, and this requirement has been met by the installation of Vokes Genspring Variable Support Hangers. The Associated Ethyl Company Limited have also made use of these Vokes Genspring Hangers at their Ellesmere Port Works in Cheshire.



Photograph by courtesy of The British Petroleum Company Limited.

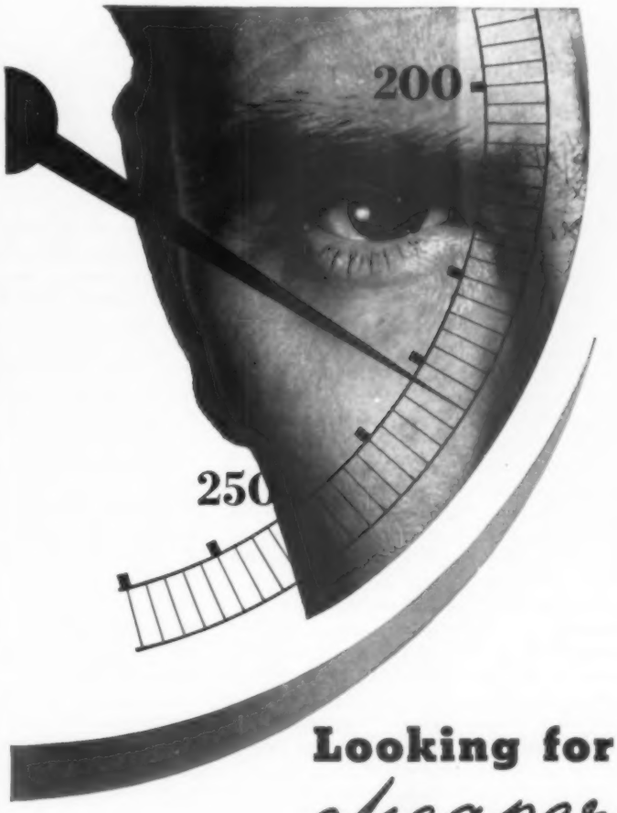
VOKES GENSPRING Variable Support Hangers are specifically designed for the control of vibration and limited thermal movement of piping, but where piping systems need to be 'floated' to offset the efforts of extensive movement, Vokes Genspring Constant Support Hangers should be used. The full range is detailed in the Vokes Genspring catalogues available on request.

VOKES GENSPRING

SUSPENSION SYSTEMS

VOKES GENSPRING LIMITED · GUILDFORD · SURREY

VG/4



Looking for *cheaper* steam?

9 million tons of coal alone are wasted in Britain every year through inefficient boiler practice in industry. With fuel so costly, no steam user can afford to ignore economy. Rather let us try to generate a little more steam from every ounce of it, or, better still, from every B.T.U. of waste heat.

Senior Economisers do just that. By taking the valuable waste heat from the flue gases to preheat the feed water they can increase efficiencies by 5 to 15%. Due to their patented H-gilled heat exchange tubes and straight-through, vertical gas passages they combine high effective heat transfer with a minimum draught loss.

A Senior Economiser can be fitted to any type of boiler burning more than 20 tons of fuel weekly, of any type.

It would pay you to write for further details.

Senior H TUBE **economisers** *for cheaper steam*

SENIOR ECONOMISERS LIMITED, 11 SOUTHAMPTON ROW, LONDON, WC1

Telephone: Holborn 7543/4

TA 10177

removed from the reaction product without exposing it to temperatures above 100° C.

A series of patents deal with reactions of olefins with sulfur compounds. T. K. Hanson and L. M. Kinnard (2,748,144 to Esso Research and Engineering Co.) cause sulfur and aryl olefins to react producing thiophene derivatives. This takes place at elevated temperatures and in the presence of a rubber vulcanization accelerator. Sulfone thioethers are prepared according to W. F. Wolff and G. D. McLeod (2,744,937 to Standard Oil Co. of Indiana) by reacting a thiasulfone with an olefin in the presence of an acidic condensation catalyst. In 2,763,-593 (C. J. G. Leesemann to Esso Research and Engineering Co.) a process is proposed to remove mercaptans from sour hydrocarbon fractions containing olefins. The fractions are exposed to light radiation of wave length from 1850-3600 Å at 100°-150° F. for 1-120 minutes, causing the olefins and mercaptans to form thioethers. Unreacted mercaptans are removed by extraction with aqueous, alkaline hypochlorite solutions.

Reaction of olefins with nitrogen compounds is the subject of the next series of patents. B. F. Crowe and O. C. Elmer (2,-742,502 to the Texas Co.) prepare aliphatic anilides by reacting olefins and formanilide in a CO atmosphere at 80°-200° C. and 500-6000 psig in the presence of cobalt carbonyl as catalyst. A patent assigned to Socony Mobil Oil Co. (2,745,853 by L. A. Hamilton and R. H. Williams) claims the preparation of amides by reaction of olefins with formamide or N-alkyl formamides in the presence of a peroxide. Reaction times are from 5-70 hours at the activation temperature of the peroxide. C. J. Schmidle of Rohm and Haas Co. (2,778,826) makes tertiary amines by reacting an olefin with formaldehyde and a secondary amine. Catalysts recommended for the reaction are sulfuric acid, aryl or alkyl sulfonic acids, phosphoric acid, or the acid form of an ion exchange resin.

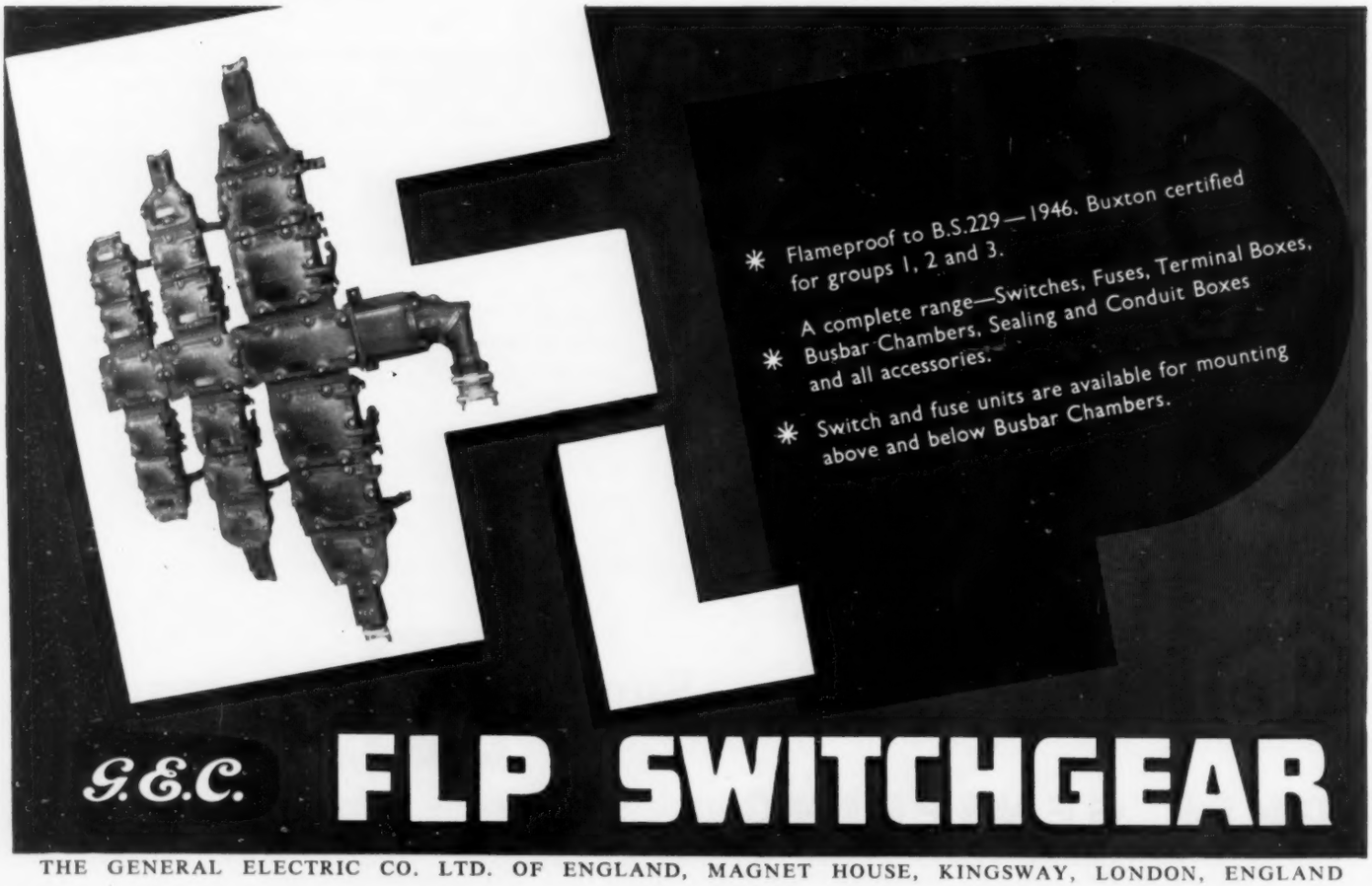
Esters are made from olefins according to the following two patents. In 2,764,610 (to Allied Chemical and Dye Corp.) R. C. Kuder reacts vinyl cyclohexene with formic acid containing not more than 10% water. The reaction is in the absence of an acidic catalyst and produces formates of vinyl cyclohexanols and formoxyethyl cyclohexyl formates. W. Reppe, H. F. Worms, and K. Wiebusch (2,771,478 to Badische Aniline —und Soda-Fabrik, A.G.) prepare esters from olefins, CO, and alcohols in a liquid medium containing a catalyst comprising nickel carbonyl and an alkali metal or ammonia cyanide.

A group of patents are next presented which deal with miscellaneous olefin reactions. Propylene tetramer and maleic anhydride are caused to react by J. C. D. Oosterhout, W. L. Banks, W. F. Glassmire (2,741,597 to the Texas Co.). The product is an alkenyl succinic acid, which, after hydrolysis with water at elevated temperatures forms the corresponding succinic acid.

F. P. Otto in 2,745,863 (to Socony Mobil Oil Co.) claims the preparation of alkaryl phosphoric acids by reacting one mole of P_2O_5 with 1-3 moles of a phenol and 1-3 moles of an olefin with 3-24 carbon atoms. The temperature is between 50°-125° C.

In 2,763,703, isobutylene is cracked to form methylacelytene and allene in good yields. The inventors, J. Happel and C. J. Marsel carry out the reaction at atmospheric pressure and 800°-900° C. in the presence of at least 50 mole percent steam with contact times from 0.01-10 seconds.

J. W. Copenhaver of General Aniline and Film Corp. (2,768,212) has patented a method for producing the diethers of glycols. The process consists in reacting equimolar amounts of an olefin, chosen from styrene, isobutylene, polybutenes and polypropylenes, with a formal, acetal, ketal, or their sulfur analogs. Anhydrous conditions are maintained and an acidic catalyst is used. N. C. Carter and J. S. Cormeans (2,-775,631 to the Phillips Petroleum Co.) produce aromatics from n-pentene or n-hexene by reacting them with CO_2 over a molybdena-silica-alumina catalyst. The olefin/CO_2 ratio should be less than 2 and the temperature between 750°-1100° F.


* Flameproof to B.S.229—1946. Buxton certified for groups 1, 2 and 3.
* A complete range—Switches, Fuses, Terminal Boxes, Busbar Chambers, Sealing and Conduit Boxes and all accessories.
* Switch and fuse units are available for mounting above and below Busbar Chambers.
G.E.C. FLP SWITCHGEAR
THE GENERAL ELECTRIC CO. LTD. OF ENGLAND, MAGNET HOUSE, KINGSWAY, LONDON, ENGLAND

WORLD PETROLEUM POLICIES

It is An exact chronological account with quotations from original sources of factors, statements and opinions affecting the petroleum industry's relations with the public and governments, both here and abroad, **KEPT UP TO DATE.**

By A distinguished oil editor, LEONARD M. FANNING.
Author of: "The Rise of American Oil," "American Oil Operations Abroad," "Foreign Oil and the Free World."
Editor of: "Our Oil Resources."
Secretary of the National Oil Policy Committee, Petroleum Industry War Council, World War II.

Over 1,000 Briefs and Excerpts Given in Chronological Order.

CONTENTS

PART VIII	**The Suez Crisis—1956-1957** **"ERA OF THREAT"** **1st Quarter Supplement 1957** **2nd Quarter Supplement 1957**
PART VII	**Postwar Problems and Policies—1946-1956** **"ERA OF EMERGENCY"**
PART VI	**World War II Policies—1942-1945** **"ERA OF COOPERATION"**
PART V	**Nationalization Policies and Foreign Oil—1936-1941** **"ERA OF RESTRICTION AND INVESTIGATION"**
PART IV	**USA Oil Conservation Policy—1924-1935** **"ERA OF SURVIVAL"**
PART III	**Shortage Scare and Foreign Oil—1919-1923** **"ERA OF EXPANSION"**
PART II	**America in World War I—1917-1918** **"ERA OF RESPONSIBILITY"**
PART I	**Enter: The Gasoline Age and World War I—1910-1916** **"ERA OF ARRIVAL"**

The entire leather-bound volume is over 400 pages, concisely edited and completely indexed for ready use. It is a service which is renewed quarterly by revisions which bring the material contained up to date. For example, it would include the latest government investigations, latest quotations from industry leaders on oil, in short it covers the field and gives a single reliable source for all the information formerly scattered in many different places, plus up-to-date supplements.

The entire cost of this volume is $195, including revision service for one year. After that time the revision service can be continued for $52.50 yearly, including all costs. It may be received for your inspection without obligation.

WORLD PETROLEUM POLICIES

604 FIFTH AVENUE, NEW YORK 20, N.Y.

International News and Notes

Seismic Work Stepped Up By Sahara

Plans for a 40% expansion of seismic crews by French and English subsidiaries of Seismograph Service Corp., Tulsa, has been announced by G. H. Westby, president of the worldwide seismic firm. Mr. Westby returned recently from a tour of Europe where he discussed 1958 plans with officials of Seismograph Service Ltd., the English subsidiary, and Compagnie Francaise de Prospection Sismique, the French company.

Regarding operations of the French firm, Mr. Westby said there will be a "terrific" expansion of seismic exploration in the Sahara desert. "There is no question but what there are large oil reserves in the Sahara."

"Plans for expanded exploration activity there are going ahead. These oil reserves are going to mean a great deal to France and the French companies. The French colonies are coming into their own as far as oil reserves are concerned. The first tanker with oil from the Cameroons arrived in France while we were there, and they were quite excited about it."

Turbine to Operate on Freight Refinery Gas

First USA gas turbine ordered and scheduled to be installed on the European continent has been ordered by Compagnie Française de Raffinage from General Electric's gas-turbine department. The 7,850-hp unit will convert a waste byproduct into useful mechanical and thermal energy.

The gas turbine will operate on "tail gas," a waste product of the Normandie refinery. The gas, with a heating value of 500 Btu per cu ft, will be mixed with the air compressed by the turbine's axial-flow compressor and burned in the unit's six combustion chambers. The hot combustion gas will pass through the two-stage turbine, which will drive propane and ethylene compressors integrated with the refinery process, and then will be piped through a heat-recovery boiler to produce 30,000 lb per hour of process steam. The turbine is of simple-cycle two-shaft design.

Delivery of the gas turbine to France is expected early in 1958. Order was obtained by International General Electric, GE's overseas organization.

World Tanker Report by Sun

Continuing decline in Uncle Sam's share of the world's tanker fleet may soon drop the USA from the position of leadership it has held since World War II, according to the 15th annual analysis of the world tankship fleet made by the Statistical Research Division of Sun Oil Co.

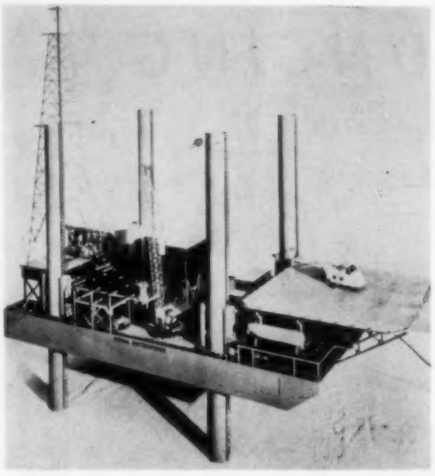
Closest challenger to America's leadership was the United Kingdom, which controlled 16.1% of the world's carrying capacity at the end of 1956. Norway ranked third, with 15.0%; followed by Liberia, with 14.1%; and Panama, with 7.6%.

The analysis showed a world tankship fleet of 2,778 vessels (of 2,000 or more gross tons) as of December 31, 1956. Aggregate deadweight tonnage amounted to 44,882,600 tons.

In terms of carrying capacity, the fleet was the equivalent of 2,614.2 T2-SE-A1 tankers, a World War II type used as a common denominator by the analysts. All national fleets were equated to an equivalent number of T2's of 16,765 deadweight tons each and capable of steaming at 14.5 knots. On this basis, the world fleet at the end of 1956 represented a 9.0% increase over the previous year.

Albanians to Increase Output 1½ Times

Albanian exploratory drilling is now concentrated in the Myzequeja plain. In 1960, crude production is planned to be 1.5 tons greater than in 1955. Estimate for 1955: 200,000 metric tons (5,000 b/d) and processing capacity 3.7 greater.



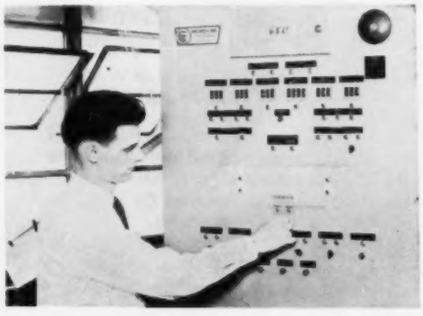
PERSIAN GULF SUPPLY FLEET: One of the major problems in the under-water search for oil in the Persian Gulf, where Abu Dhabi Marine Areas Ltd. is to drill a deep test well early next year, is transportation of men and supplies. To supply the base camp established on Das Island, some 60 miles from Das, a supply fleet is being assembled. The first vessels of this fleet, two 100-ton barges, left London this summer as deck cargo on the "City of Durham."

The fleet will eventually consist of five 100-ton barges, a 30-ton refrigerated barge, and three 73-ft steel tugs—all of which are being especially built for the project. They will carry food and materials from Bahrein to Das Island, and from there supply the men aboard the drilling barge, "Adma Enterprise."

Tapline Installs Unattended Stations

Trans Arabian Pipe Line Co. is installing an unattended satellite pump station at Tufaih, between Qauisimah and Qatif, as a part of its current expansion program to increase pumping capacity across to the Mediterranean.

The installation will be unique in that electrical instrumentation, data-processing units, tone-shift terminals, UHF radio equipment; and a satellite station control and monitoring equipment will be permanently mounted in a large trailer van, hauled to the pump-station site and wheeled into the desired position. There it will operate in conjunction with supporting equipment, housed in two other similar vans—which includes a 5,000-hp gas turbine, a crude-oil pump, combustion and air filtering equipment, measuring instruments, turbine sequence control, and generator.



TAPLINE UNATTENDED PUMP STATION: Union Switch & Signal base-station control panel to be located at Abqaiq from which the pump station will be controlled. This panel will also automatically provide visual, digital, and permanently logged readout of telemetered information from the satellite pump station.

SPARLING TANK

& MFG. LTD.

is pleased to include the following companies among its clients:

ALASKA
Morrison-Knudsen Co. Inc.

BRITISH COLUMBIA
Alaska Pine & Cellulose Ltd.
Canadian Bechtel Co. Ltd.
Caribou Engineering Co. Ltd.
Imperial Oil Limited
Royalite Oil Co. Ltd
Shell Oil Co. of Canada, Ltd.
Standard Oil of B.C. Ltd.

ALBERTA
Ford, Bacon & Davis Constr. Corp.
Husky Oil & Refining Ltd.
Mannix Gill Ltd.
Pembina Pipe Line Co. Ltd.
Socony-Vacuum Oil Co.

SASKATCHEWAN
Consumers' Co-op. Refineries Ltd.
Husky Oil & Refining Ltd.
Imperial Oil Ltd.
Refinery Engineering Co.
Royalite Oil Co. Ltd.
South Saskatchewan Pipeline Ltd.
Trans Canada Pipe Line Ltd.

MANITOBA
Anglo-Canadian Oil Co. Ltd.
Procon (Canada) Ltd.
Defence Construction (1951) Ltd.

ONTARIO
The Bell Telephone Co. of Canada Ltd.
Blaw-Knox Co.
C. F. Braun & Co.
British American Oil Co., Ltd.
Canadian Bechtel Co. Ltd.
Canadian General Electric Co. Ltd.
Canadian Industries (1954) Ltd.
Canadian National Railways
Canadian Oil Companies Ltd.
Canadian Pacific Railways
Canadian Petrofina Ltd.
The Carter Construction Co. Ltd.
Catalytic Construction of Canada Ltd.
Defence Construction (1951) Ltd.
Dow Chemical of Canada Ltd.
Dryden Paper Co. Ltd.
Faraday Uranium Mines Ltd.
H. K. Ferguson Ltd.
The Fluor Corp. of Canada Ltd.
General Refractories Co. of Canada Ltd.
Girdler Corp. of Canada Ltd.
Hill Clark Francis Ltd.
Hydro-Electr. Power Comm. of Ontario
Imperial Oil Limited
Industrial Acoustics Co., Inc.
International Nickel Co. of Canada Ltd.
Kilborn Engineering (1954) Ltd.
Lever Brothers Ltd.
Liquifuels Limited
McColl-Frontenac Oil Co. Ltd.
A. G. McKee & Company
C. A. Meadows & Assoc.
Municipality of Metropolitan Toronto
National Research Council
North American Cyanamid Ltd.
Quaker State Oil Refining Corp.
Regent Refining (Canada) Ltd.
St. Lawrence Starch Co. Ltd.
Shell Oil Co. of Canada, Ltd.
Swansea Construction Co. Inc.

QUEBEC
L'Air Liquide
The Bell Telephone Co. of Canada Ltd.
British American Oil Co. Ltd.
Canadian Kellogg Ltd.
Canadian Petrofina Ltd.
Fluor Corp. of Canada Ltd.
Fraser-Brace Engineering Co. Ltd.
GECO Mines Ltd.
Hilton Mines Ltd.
Imperial Oil Ltd.
Irving Oil Co. Ltd.
McColl-Frontenac Oil Co. Ltd.
Noranda Mines, Ltd.
Proctor Engineering Co.
Shawinigan Chemicals Ltd.
Shell Oil Co. of Canada, Ltd.

NEW BRUNSWICK
British American Oil Co. Ltd.
Canadian Petrofina Ltd.

NEWFOUNDLAND
Foundation-Maritime Ltd.
Shell Oil Co. of Canada Ltd.

NORTH WEST TERRITORIES
Foundation Co. of Canada, Ltd.
Gunnar Mines Ltd.

illustrated at right is field assembled water softener installed at British American Oil Company Limited, Clarkson, Ontario

SPARLING TANK & MFG. LTD.

NEW TORONTO, ONTARIO

plate-design
fabricating
erection
by

SPARLING TANK
& Mfg. Ltd.

NEW TORONTO ONTARIO, CANADA

3rd Quarter Crude Demand 7.2 Million B/D

Demand for domestic crude is expected to average about 7,200,000 b/d during the last four months of this year, an increase of 300,000 b/d above the same period in 1956, according to the Independent Petroleum Assn. of America in its monthly supply and demand outlook. The association cautioned, however, that this increased market "could be delayed until (a) seasonal increase in demands improve the inventory situation, and (b) imports of foreign crude are reduced to levels recommended (by President's Cabinet Committee last month)."

Total domestic demand during the last four months of the year, assuming normal weather conditions, will be approximately 9,400,000 b/d. This would be an increase of 550,000 b/d, or 6%, above the same period in 1956 when weather was warmer than normal.

New Portable Offshore Vessel

Union Producing Co., Shreveport, La., recently awarded a contract to Todd Shipyards Corp., of Houston, for a portable, self-stabilizing, submersible, elevated-deck drilling unit for service in the Gulf of Mexico.

The new unit has been designed to operate in open sea water 76 ft deep, and in lesser depths during hurrican season. It consists essentially of a slotted hull with an elevated drilling deck, supported by fixed columns. Lowering and raising of the hull is effected by ballasting. Stability during lowering and raising operations is maintained by four vertical stabilizing caissons. The hull is of anti-scouring design—with sloped sides and ends. The vessel will contain a 143-ft 1,000,000-lb cantilever derrick and all necessary drilling machinery and equipment for drilling to depths in excess of 20,000 ft, diesel generators, helicopter landing deck, and airconditioned quarters.

With the export business of the oil and gas industry equipment manufacturers supply and service companies on the increase, the May 14-23, 1959, International Petroleum Exposition is making plans for a large attendance from the oil nations of the world. Left is General Manager William B. Way and W. K. Warren, chairman of the board of Warren Petroleum Corp. and exposition president, studying worldwide attendance possibilities. Previous shows had attendants from more than 50 countries. The Nomads organization will serve as hosts to delegates attending from other countries.

Sinclair Venezuelan Personnel

Sinclair Oil & Gas Co. has announced that it had recently transferred three operating people from its Houston Division to Sinclair's Venezuelan affiliate, Sinclair Oil & Refining Co. They are: Oscar C. Holmes, production; Leroy D. Lane, petroleum engineer; and John W. Logan, warehouse man. All are currently stationed in eastern Venezuela.

Joins Gravity Meter Companies

Charles B. Officer, Jr., has become associated with the Gravity Meter Exploration Co., in Houston, and associated GMX Corp., minerals consultants, and Geophysical Associates International.

Most recently an associate professor of geology at Rice Institute, Dr. Officer has specialized in various aspects of marine geophysics and geology, under-water sound transmission, wave and ray propagation, tectonics, and structure of the earth —both theoretical and experimental.

Charles B. Officer, Jr.

PIPELINES are NOT SIDELINES with...
WILLIAMS BROTHERS
ENGINEERS and CONSTRUCTORS
NBT BLDG. • TULSA, OKLAHOMA • CABLE ADDRESS: WILLBROS
New York • Washington • Louisville • Minneapolis • New Orleans
CANADA • BOLIVIA • COLUMBIA • VENEZUELA • TURKEY
OIL • GAS • WATER • PRODUCTS PIPELINES • PUMPING STATIONS

Oil in the French Union

Sahara Concession Rush: Two of the five major oil ventures active in the French-controlled Sahara have reapplied for a five-year renewal of their concessions. These are the Société Nationale de Réchèrches et d'Exploitation des Pétroles en Algérie, known as the SN Repal, and the Compagnie Française des Pétroles Algérie, known as CFPA, which owns a 23.75% interest in the Iraq oil fields. Both are owned jointly by the French government and the general government of Algeria.

Under the terms of France's mining law, these companies to which the Sahara concessions were granted on October 15, 1952, are to release half of their total acreage here on October 24, 1957, after a first five-year term. They have already picked out those sections they mean to explore and develop.

In the queue for the released acreage are already some established American oil ventures, and a number of lesser-known independent operators which have gone into partnership with French capital. The Compagnie Universèlle du Canal de Suez is to take an interest in the search for oil in the Sahara. To this effect, it has set up a holding company, the Compagnie de Participations et de Réchèrches d'Exploitation Pétrolière, to be known as COPAREP, owned jointly with the Banque de Paris et des Pays-Bas, the Société Lyonnaise des Eaux et de l'Eclairage, the Société Lebon, and the Compagnie d'Assurances Générales sur la Vie.

The following are the oil-and/or gas pools already uncovered by the CFPA and the SN Repal. The Talemzane find is situated on CFPA's Laghouat perimeter. The Hassi R'Mel, a gas and oil find, is located in its Berriane concession. At latest report, 2 HR encountered at 6,609 ft the same thickly gas-impregnated limestone reservoir, of Trias age, evidenced by 1 HR. A drill-stem test in open hole flowed 1,200,000 cubic meters per day of condensate-bearing wet gas, under at bottom-hole pressure of 270 kg per sq cm. Field reports put local reserves at 130 billion cubic meters, as against the 150 billion contained by the Lacq deposits in metropolitan France. As the output of all Algeria's gas works currently aggregate only 90 million cubic meters per year, the strike is of paramount importance for the economic development of the country.

It is noteworthy that the Hassi-Massouad ("Hassi" means "well" in the local idiom) straddles SN Repal's Oued-Mya concession and CFPA's Ouargla permit. I OM, drilled by CFPA 5 miles N of 1 MD, the discovery hole, traversed 620 ft of the same thickly oil-impregnated quartzite series of the Trias, plus 62 ft of water, and is currently coring below 10,000 ft. A drill-stem test resulted in a goodly flow of light crude, with a specific gravity of around 0.800, containing no sulfur to speak of.

The fact that I OM, I MD, and 2 MD tested oil from about the same intervals may make the Hassi-Massouad structure one reservoir, stretching 15 miles between I OM and 2 MD. Offsetting this are great variations in porosity and permeability, obtaining horizontally as well as vertically.

7 OM, 5 miles to the E of I OM, is currently drilling below 3,100 ft; while 3, 4, and 5 MD stand at various stages of spudding. The local producers currently yield a shade under 300 b/d of a better-grade crude. After filtering, it is used to power the fleet of 20-ton 200-hp truck transports from Algiers. A field for the heaviest planes, a road to Ouargla, and a whole boom town, to be called "Messouad City," are already under construction here.

A network of privately run radio communications, blanketing the whole desert, is to replace shortly the piecemeal haphazard military system currently in operation. Known as "Radio-Sahara," it will have headquarters at the strategically located oasis of El-Golea, to speed operations of heavy trucks in these stretches. Two-way radios will insure proper communications with prospection headquarters, drilling locations, and the main oases. A series of well equipped radiostations is being constructed in all three places.

The CFPA's and SN Repal's finds have evidenced the importance of the Trias in central Sahara. Over widespread sections in the western Sahara, the Silurian may well prove a potential pay. According to one report, a Silurian schist sample, taken from a small oasis to the S of Ougarta, some 500 miles S of the western Mediterranean, yielded 4% of hydrocarbons under chloroform treatment.

In eastern Sahara, bordering on Lybia, the 35% Shell-owned Edjelé and Tinguentourine finds have revealed the possibilities of a third potential pay. The Compagnie de Réchèrches et d'Exploitation des Pétroles au Sahara, known as CREPS, has found production in both places from Carboniferous sandstones.

Near Edjelé, a well was spudded at Tin-Essameid, on the Issaouane Erg, to obtain a satisfactory supply of water to drill. Instead, on August 7, it struck gas unexpectedly at a depth of around 560 ft, and caught fire. Core holes previously drilled in the area had revealed existence of such shallow impregnated layers at depths from 250 ft.

Summer heat and the sirocco, a withering desert wind, have fanned the flames into a raging inferno which has already lapped up 3,500 lb of foam, plus 60 cubic meters of water.

Possible Pipeline Sabotage: The prospective Hassi-Massouad and Hassi R'Mel pipelines, along their course to the western Mediterranean across thickly settled regions, will be open to sabotage. It is planned to double them up with parallel roads —12,500 miles of roads are currently constructing in the Sahara—to be heavily patrolled around the clock. Helicopters will be also used to guard the pipelines against eventual sabotage.

In this connection, Monsieur P. Lente, the spokesman for France's pipeline constructors, recently announced that orders have been placed with them for the Edjelé-Tinguentourine-western Mediterranean affair, which will take 58,000 metric tons of steel. The 16-in. 375-mile-long pipeline will be made of seamless steel.

The French pipeline industry, practically non-existent before World War II, has already constructed 6,000 miles of pipelines, of which 3,500 miles, functioning under high pressure, have been absorbed by the government-run Gas Board. The network to move off the gas from Lacq will take in many more thousands of additional miles; 20- and 25-in. pipelines are currently turned out to the tune of 1,000 miles a year at the Sedan works, whose capacity is to be doubled by 1960. Two additional works at Maubeuge and in Normandy will be soon commissioned to cater to the big Saharan demand.

French Exploration Rises: The new discoveries all over French-controlled territories act as a powerful stimulus to reconnaissance work. This is reflected in the figures on the exploration and extension footage: 727,986 ft were drilled in metropolitan France in the first half of 1957, as against 575,490 for the corresponding period of 1956. In regard to the Sahara, the corresponding figures are 715,086 ft and 121,848 ft.

The production figures of natural gas for metropolitan France were 245,981,000 and 172,280,000 cubic meters during the periods under review. During the January-July 1957 period, France produced a grand total of a shade under 7.5 million barrels of crude, representing a 26% boost over 5,653,722 withdrawn in the first half of 1956. For French-controlled Africa south of the Sahara, the corresponding figures are 537,615 bbl and nil; while North Africa produced 407,827 bbl and 637,722 bbl. The almost total depletion of the Oued-Guetterini pool accounts mainly for this fall-off. But the Saharan crude may alter dramatically the whole French picture by next year.

Neutral Zone Production Up

Crude-oil exports of the Kuwait Oil Co. reached 40,936,594 bbl, a new monthly record, in June. Exports to the USA were 7,390,509 bbl. Exports for the first six months were 180,947,095 bbl. Distillate exports for the first six months were 574,916 bbl.

American Oil Co. crude-oil exports in June were 977,716 bbl, up 7.5% from May, making the six-month total 3,203,197 bbl. Of the six-month figure, 2,635,792 bbl went to Japan, 492,674 to Italy, and 74,731 to Netherlands.

Getty Oil Co. crude exports were 1,045,001 bbl in June, a decrease of 20,000 bbl from May. Getty's first six-month exports were 5,405,255 bbl, of which 4,082,878 went to the USA. Combined production, based on exports, was 67,400 b/d during June, averaging about 47,000 b/d during first half.

Soviet Concession to Austrian Reparations

Austrian Commission for Reparation Deliveries to the Soviet Union has announced Soviets will accept "other" goods instead of 100,000 metric tons (2,000 bd) of crude as part of Austria's reparation deliveries in 1958. Further indications are they may also accept other goods for another 200,000 metric tons (4,000 b/d) of crude. This would save the Austrian Mineral Oil Administration some $4 million for other investments. The annual crude reparations would thus be reduced to one million metric tons (50,000 b/d).

USSR Cheaper Offshore Drilling

As many offshore wells are to be brought down in the Caspian Sea during the next three years, drilling-equipment works in Baku are soon to start the production of 400-ton floating platforms, thereby saving an estimated $5 million per year.

Another method of offshore drilling, allegedly 60% cheaper than the hitherto used platforms on pile work, is to be used for the exploitation of Azerbaidjan's greatest gas deposit which produces 247 mmcf of gas per day. This Karadag gas field, which extends into the Caspian Sea, is to be exploited by means of dams, built into the sea and fortified by drift sand. A complete network of dams is thus to be constructed.

Siam Refining Planned

The government of Thailand is going ahead with plans for construction of a refinery. Eastern International Development Corp. Ltd. was awarded a contract for a plant near Bangkok to refine 5,000 b/d. Talks about prices are yet to be completed.

Oceanic Petroleum Corp. of Panama submitted a proposal to the government for a plant near Amphur Sriracha, Cholburi province, to handle 15,000 to 20,000 b/d. Shell Ltd. proposed a large refinery, as a private investment—which, if carried out, would be the largest industrial enterprise in the country.

Finally, construction of a refinery in Amphur Farng, province of Chiengmai, is proceeding. Oil prospecting and drilling are under way. A contract has been signed with Refining Associate of California for a plant of 1,000 b/d.

Gulf in Angola

Cabinda Gulf Oil Co. is about to sign a contract calling for spending about $3 million in the next three years for exploration for crude oil and gas in Portugal, it has been announced by the government. The contract is to allow an additional two-year extension with spending about $3,200,000 more money.

Upon finding of oil, the company would have development rights for 50 years, and the period could be extended for another 20 years. Within three months of signing of the contract, the company is to present a program for exploration covering first-year operations.

Area to be covered is the entire coast line of the Cabinda district and extending inland for about 30 miles, including offshore rights. A supplemental contract is to be concluded under which the province of Angola may participate.

Oil Company Staff Changes

RICHARD F. BLEWETT has been appointed manager of the foreign sales department, Sun Oil Co. He was formerly managing director of Sun Oil Co. (Belgium) a wholly owned subsidiary. In his new post he will coordinate sales for three Sun Oil Co. subsidiaries in Europe and 57 distributors throughout the free world.

ALFRED T. KROOK has been elected a vice president of Bechtel Corp. and its associated companies, Bechtel International Corp. and Canadian Bechtel Ltd. He will concentrate principally in western Canada and northwestern USA areas—working closely with S. D. Bechtel, Jr., and S. M. Blair, vice chairman and president of the Canadian company.

Mr. Krook formerly was president and a director of Stone & Webster Canada Ltd., Toronto, and a vice president of Stone & Webster Engineering Corp., New York. As western manager for the latter firm, he directed its operations in this part of the country until recently. He comes to Bechtel from Engineering Management Inc., where he has been vice president and general manager.

FRED W. ARGUE, vice president and engineering manager, and **EDWARD J. FORD**, vice president and senior construction manager, of Stone & Webster Engineering Corp., have been elected directors of the firm.

REAR ADMIRAL H. B. MILLER, USN (Ret.), has resigned from the American Petroleum Institute, effective August 31. On September 1, Mr. Miller will assume the duties of director of public relations of Pan American World Airways. Philip C. Humphrey has been designated as acting director of the API Department of Information and acting executive director of the OIC, effective September 1.

JOSEPH W. MEEHAN has been elected vice president of Derby Refining Co., Wichita, Kans.—with responsibility for transportation and crude-oil supply. Mr. Meehan was for 25 years associated with Pure Oil Co., Chicago—most recently as general manager of its crude-oil purchasing division, and as president of Pure Transportation Co. and president of Arapahoe Pipe Line Co.

GEORGE F. ADAMS has been named vice president in charge of manufacturing for D-X Sunray Oil Co., Tulsa. He has been with Universal Oil Products Co. for eight years.

ANSON W. KRICKL has been appointed general manager of manufacturing by Badger Manufacturing Co., Cambridge, Mass. Mr. Krickl will assume responsibility for manufacturing activities connected with the production of Badger service-rated expansion joints and Badger water-distillation equipment. He will be located at the 230 Bent Street, Cambridge, headquarters of the firm.

Anson W. Krickl

R. D. HANLEY, vice president of Magnolia Petroleum Co., has been appointed assistant superintendent of Magnolia Petrofining Co.'s natural-gas department with headquarters in Dallas. He has been district superintendent at Morgan City, La., in charge of the natural-gas operations in the Gulf of Mexico.

JED B. MAEBIUS has been appointed to the newly created position of senior geologist for domestic exploration in Tidewater Oil Co.'s headquarters exploration department in San Francisco. Before joining Tidewater, he spent 20 years with the Gulf Oil Corp.

JAMES W. GREELY, former US Navy ship salvage specialist, has joined Kerr-McGee Oil Industries Inc., as general marine superintendent. Mr. Greely replaces Leo P. LeBron, who has been placed in charge of the company's Venezuelan drilling operation.

WALTER C. CASH has been named advertising manager of The Fluor Corp. Ltd., Los Angeles, engineering-construction firm, succeeding Walter E. Terry.

Fred Brechtel *Paul Fuenning*

FRED BRECHTEL and Paul Fuenning have each been named vice president of Geophoto Services Ltd., Calgary, Canada. Mr. Brechtel, who joined the Geophoto group in 1949, will be responsible for general administration and client relationship. Mr. Fuenning, a member of the group since 1946, will be in charge of geological operations. The two new positions reflect Geophoto's rapidly expanding Canadian operations.

Miss LOUISE SHERRILL, assistant secretary of the Brewster-Bartle Drilling Co. Inc., has been elected president of the Houston Desk and Derrick Club for 1957-58—succeeding Mrs. Ida Griffith.

CHARLES H. ATWOOD has been appointed president of Union Carbide Caribe Inc., a subsidiary of Union Carbide Corp. Union Carbide Caribe will operate the new petrochemicals plant under construction near Ponce, Puertico Rico, which will produce ethylene oxide and derivatives.

Mr. Atwood joined Union Carbide in 1927. He was born in Fulton, N.Y. He was graduated by the University of Pittsburgh, Pittsburgh, Pa., with the degree of bachelor of science in chemical engineering, in 1927.

R. S. HATCH, general manager of materials, supply, and traffic, and a vice president and director of Aramco Overseas Co., recently completed 30 years of service with Aramco and associated companies.

Following his graduation in 1927 from MIT, Mr. Hatch started to work in the refining department of The Texas Co. at the Port Arthur, Texas, refinery. He had become manager of the purchasing department of The Texas Co. by 1946; and, after 20 years with Texaco, joined Aramco in October 1947, to become manager of manufacturing and processing in New York. In 1952, he was elected executive vice president of Aramco Overseas Co., and spent several years at The Hague before going to his present assignment in Saudi Arabia.

Robert N. Williams

ROBERT N. WILLIAMS has been appointed consultant geologist to Empresa Nacional del Petroleo (ENAP), the Chilean government oil agency, and will make his headquarters in Punta Arenas. Mr. Williams, a University of California graduate, has been chief geologist of Coronet Oil Co. for the past five years, with headquarters in Midland, Texas, and prior to that worked in California.

JOHN B. RUSHMER, until recently located in Iran, has joined employee-relations department of International Petroleum Co. Ltd., in Coral Gables, Fla. Previously he had been in Saudi Arabia for Arabian American Oil Co. In 1955, he joined the newly established Iran Operating Companies as personnel research superintendent, and worked in that capacity until assuming his new position at International Petroleum's executive office.

O. C. CLIFFORD, Jr., chief geophysicist of The Atlantic Refining Co., Dallas, Texas, has been elected president of the Society of Exploration Geophysicists,—succeeding Roy F. Bennett, Oklahoma City. Ben F. Rummerfield, executive vice president of Century Geophysical Corp., Tulsa, Okla., is to be the new vice president. Other officers will be Howard E. Itten, president of Empire Geophysical Inc., Fort Worth, secretary-treasurer; and Dr. L. Y. Faust, of Amerada Petroleum Corp., Tulsa, editor. Terms of office will begin November 11, during the society's 27th annual meeting in Dallas.

EDWARD W. LANG, vice president for marketing for Cities Service Oil Co., New York, has been named chairman of the Petroleum Division of the Muscular Dystrophy Assn. of America Inc.

HASKELL WOTKYNS has been elected executive vice president of Maloney-Crawford Tank and Manufacturing Co., Tulsa, Okla., oil processing equipment manufacturers.

WILLIAM H. HILL, Jr., vice president of Dillon, Reed & Co., New York, has been elected to the board of Falcon Seaboard Drilling Co., Tulsa, Okla. He has been with the New York financial house since 1926, and was active in the planning of Falcon's first public offering of $3,500,000 handled by Dillon Reed last April.

HAROLD J. KLEEN has assumed newly created position of manager of land, geological, and geophysical departments of Kerr-McGee Oil Industries Inc., Oklahoma City, Okla.

JOHN W. SINCLAIR has been appointed general manager of marketing for India, Burma, and Ceylon of Standard-Vacuum Oil Co.—to succeed James V. Hanlon, who is retiring at the end of the year. Robert R. Kendall has been transferred from the post of financial adviser to Stanvac's general representative in London, to succeed Mr. Sinclair as financial and accounting coordinator in Bombay.

HAROLD J. KLEEN has been appointed to the newly created position of manager of land, geological, and geophysical departments of Kerr-McGee Oil Industries Inc. He formerly was chief geologist, and continues to report to J. C. Finley, vice president in charge of exploration. Walter Marlin becomes Mr. Finley's special assistant, and D. L. Amonsett becomes chief geophysicist.

First Half Earnings Higher

Net earnings of 41 oil companies during the first half of 1947 totaled $2,259 million. This compares with a net of $1.954 million for the same companies in the first six months of 1956. Increase this year was $306 million or 15%. Ten of the reporting companies suffered a decline in earnings while 31 reported a higher net.

NET INCOME FIRST SIX MONTHS—1957
(Thousands of Dollars)

Company	Net Income 1957	Net Income 1956	Per Share 1957	Per Share 1956
Anderson Prichard .	2,820	2,782	1.58	1.66
Associated Oil & Gas .	341	128	.14	.05
Bishop Oil	144	200	.25	.35
Clark Oil Refining ..	692	1,299	.54	1.08
Colorado Oil & Gas .	764	623	.21	.15
Continental Oil	23,714	25,549	1.21	1.31
Creole Petroleum	221,648	158,655	2.86	2.04
Empire State Oil	690	653	..	..
Getty Oil ...	12,962	3,977	.88	.26
Honolulu Oil	7,016	6,861	2.03	1.83
Humble Oil & Refining	107,789	92,360	1.50	1.29
Imperial Oil	37,662	33,735	1.19	1.07
International Petroleum	23,300	18,500	1.60	1.27
Louisiana Land & Exploration	10,503	7,060	1.17	.79
Macmillan Petroleum	28	99	.026	.035
Maracaibo Oil Exploration	702	278	..	..
Midwest Oil Corp.	3,612	3,385	1.42	1.33
Monterey Oil	7,437	6,635	4.12	3.67
Ohio Oil ...	22,233	21,276	1.69	1.62
Phillips Petroleum	519,412	456,389	1.55	1.50
Pure Oil	19,012	17,826	2.21	2.08
Reserve Oil & Gas	344	586	.29	.50
Richfield Oil	13,705	14,532	3.43	3.63
Seaboard Oil	6,426	4,975	1.75	1.36
Shell Oil ...	75,321	69,441	2.49	2.29
Signal Oil & Gas	6,136	4,568	1.50	1.11
Sinclair Oil	44,848	45,104	2.93	3.10
Skelly Oil ..	19,934	15,540	3.46	2.70
Socony Mobil	132,000	124,000	2.81	2.64
Standard of Calif.	136,329	122,050	2.16	1.93
Standard of Ind.	82,577	75,904	2.33	2.24
Standard of N.J. ...	463,000	392,000	2.35	2.00
Standard of Ken.	6,332	6,250	2.43	2.40
Standard of Ohio	12,623	13,541	2.53	2.71
Sun Oil Co. .	25,187	25,139	2.34	2.48
Texas Gulf Producing	3,665	2,983	.95	.77
The Texas Co.	165,146	138,089	3.01	2.52
Tidewater Oil	20,945	21,599	1.54	1.59
Union Oil of Calif. ..	16,727	13,618	2.17	1.77
Venezuelan Petroleum	3,716	4,362	.92	1.09
Woodley Petroleum	1,749	964	2.22	1.26
Total	2,259,191	1,953,515		

Hydraulic Pumping Unit

Texsteam Corp., Houston, has developed a long-stroke hydraulic pump with maximum polish-rod loads up to 15,000 lb and 6-ft to 12-ft stroke. A foundation is not required, and the unit can be installed quickly with ginpoles or a pulling unit. Controls for regulating stroke velocity and cyclic rate are stationed at the unit base. Operating characteristics can be adjusted with the unit in motion—thus eliminating down time.

Full speed ahead for 35 . . .

This is a 32 ft. general purpose light alloy launch with accommodation for 35 passengers—one of a number on delivery to The Shell-B.P. Petroleum Development Company of Nigeria Limited. She's powered by a Perkins S.6 Diesel engine and designed for fast, reliable transport of Marine personnel *especially in tropical areas.*

Built on our patented "Two-way-tension" system of construction, this class of launch has exceptional strength and ruggedness. Ease of maintenance and economical running are additional advantages; and the light alloy hull is immune to teredo worm attack, rust, wet and dry rot, or deterioration in extreme climatic conditions.

We have a standard range of light alloy craft, from 26 ft., to 60 ft. for government duties, public authorities, industrial firms, ferries, and private use.

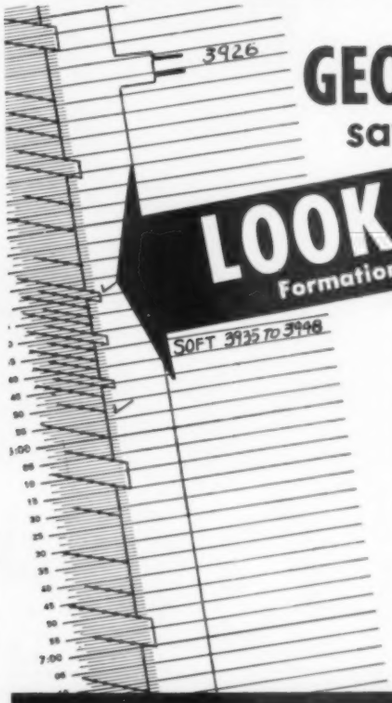
Write to Dept. P.5 for further details.

UNIVERSAL SHIPYARDS (SOLENT) LIMITED

Sarisbury Green, Nr. Southampton, HANTS. Telephone: Locksheath 3272

AP20

FORMATION CHANGES?



Drilling breaks stand out prominently on a Geograph chart. The finished charts provide a permanent, duplicate record of tremendous value. Next time you drill or have a well drilled for you, use a GEOLOGRAPH RECORDER, it works for you 24 hours a day.

Now available for export sale (except in Canada)

THE GEOLOGRAPH COMPANY®

MANUFACTURERS • EXPORTERS

27 N.E. 27TH • P.O. BOX 1291 • OKLAHOMA CITY 1, OKLA.

ADVERTISERS' INDEX

(Advertising Agencies in Italics)

A. E. Ames & Co. Ltd. — 6
MacLaren Advertising Co. Limited

Ansul Chemical Company — 8
The Brady Company

Avondale Marine Ways, Inc. — 32
Whitlock, Swigart & Evans, Inc.

Baker & Company, Inc. — 54
Stuart Sande Advertising

Bechtel Corporation — 85
Ryder & Ohleyer, Inc.

Born Engineering Company — 86
Watts, Payne—Advertising, Inc.

The British Petroleum Company Limited — 61
S. H. Benson Ltd.

The Butterley Company Limited — 1
Scott Turner & Associates Ltd.

California Texas Oil Co., Ltd. — 20
Gaynor Colman Prentis & Varley, Inc.

Cameron Iron Works, Inc. — Cover II
Boone & Cummings

The Cape Asbestos Co. Ltd. — 65
Taylor Advertising Ltd.

Chicago Bridge & Iron Company — 9
Russell T. Gray, Inc.

Cities Service Oil Co. — 57
Ellington & Co., Inc.

M. J. Crose Mfg. Co., Inc. — 84
Paul Locke Advertising, Inc.

Davison Chemical Co., Div. of W. R. Grace & Co. — 19
St. Georges & Keyes, Inc.

E. I. du Pont de Nemours & Co. (Inc.) — 17-18
The Rumrill Company, Inc.

The Empire Trust Company — 5
Doremus & Company

Foster Wheeler Corporation — 69
Marsteller, Rickard, Gebhardt and Reed, Inc.

The General Electric Co. Ltd. of England — 34, 76
Kingscott Ltd.

Geolograph Company — 83
Lowe Runkle Company

A. P. Green Fire Brick Company — 23
Al Maescher Advertising

Gulf Oil Corporation — 25
Ketchum, MacLeod & Grove, Inc.

Halliburton Oil Well Cementing Company — 36
Herbert E. Hill Advertising, Inc.

International Harvester Export Company — 15
McCann-Erickson Corporation (International)

International Paints Ltd. — 21
Mayfair Advertising Ltd.

M. W. Kellogg Company — 26-27
Fuller & Smith & Ross Inc.

The Lummus Company — 3
G. M. Basford Company

Magnet Cove Barium Corporation — Cover III
Rives, Dyke and Company

Manning, Maxwell & Moore, Inc. — 28
Fuller & Smith & Ross Inc.

McCullough Tool Company — 31
Raymond O. Perry, Advertising

Lee C. Moore Corporation — 35
Paul Locke Advertising, Inc.

Oil Center Tool Company — Cover IV
Rives, Dyke and Company

H. K. Porter Company, Inc., W-S Fittings Div. — 24
Ruthrauff & Ryan, Inc.

Procon Incorporated — 71
Sam J. Gallay/Advertising

The Pyrene Company Limited — 22
Nelson Advertising Service Ltd.

Rice Hotel — 30
Ritchie Advertising Agency

Schlumberger Surenco — 53
Rives, Dyke and Company

Senior Economisers Ltd. — 75
Taylor Advertising Ltd.

Socony Mobil Oil Company, Inc. — 13
Compton Advertising, Inc.

Sparling Tank & Mfg. Ltd. — 78-79
James Lovick & Co., Ltd.

Peter Spence & Sons Ltd. — 59
Ripley, Preston & Co. Ltd.

Standard Oil Company of California — 7
Batten, Barton, Durstine & Osborn, Inc.

Standard Oil Company (New Jersey) — 33
McCann-Erickson, Incorporated

Standard-Vacuum Oil Company — 29
McCann-Erickson Corporation (International)

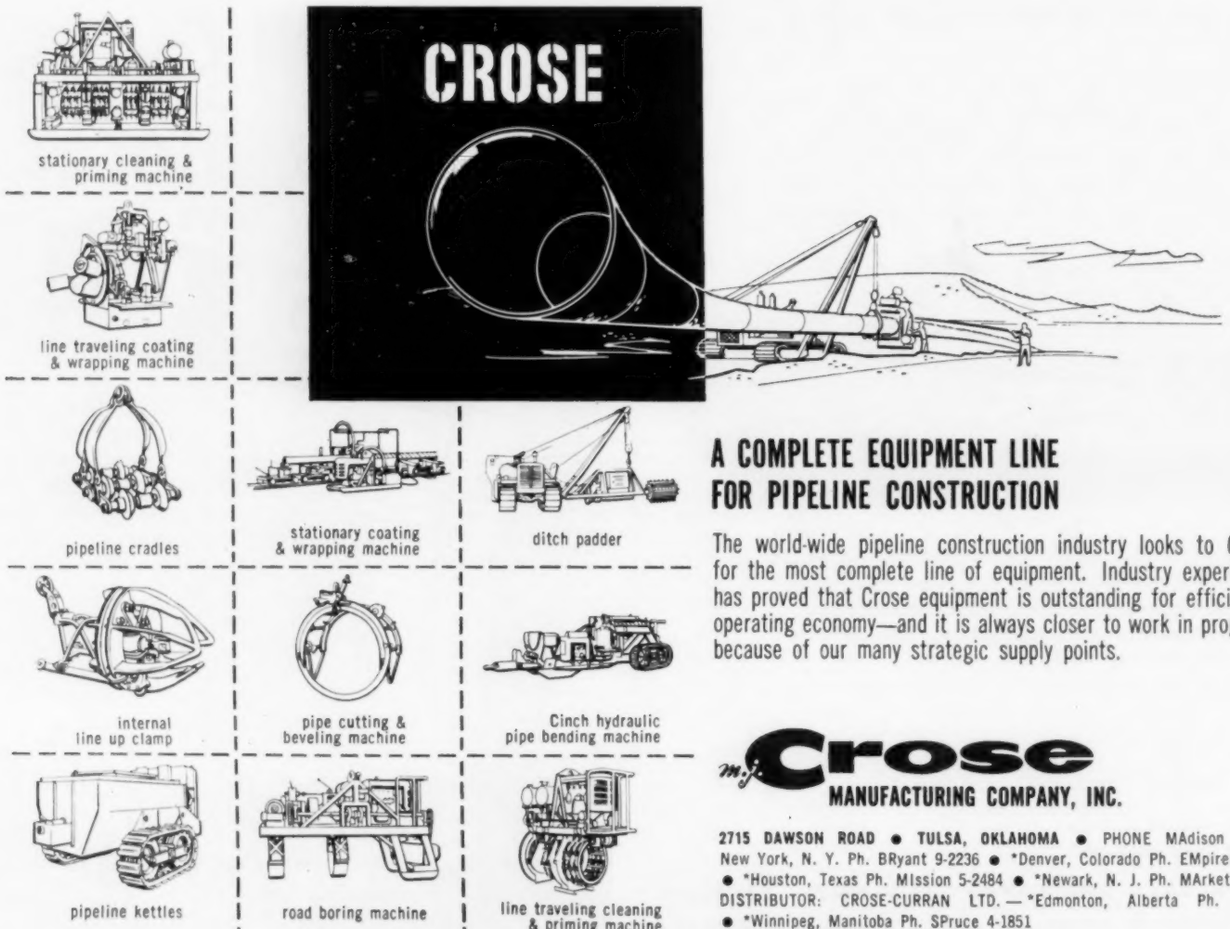
Sun Shipbuilding & Dry Dock Company — 16
Doremus-Eshleman Company

Universal Oil Products Company — 10-11
Sam J. Gallay/Advertising

Universal Shipyards (Solent) Ltd. — 83
Allardyce Palmer Ltd.

Vokes Genspring Limited — 75
Crane Publicity Ltd.

Williams Brothers — 80
Scot's Advertising



A COMPLETE EQUIPMENT LINE FOR PIPELINE CONSTRUCTION

The world-wide pipeline construction industry looks to Crose for the most complete line of equipment. Industry experience has proved that Crose equipment is outstanding for efficiency, operating economy—and it is always closer to work in progress because of our many strategic supply points.

M. J. Crose MANUFACTURING COMPANY, INC.

2715 DAWSON ROAD ● TULSA, OKLAHOMA ● PHONE MAdison 6-2171
New York, N. Y. Ph. BRyant 9-2236 ● *Denver, Colorado Ph. EMpire 6-0332
● *Houston, Texas Ph. MIssion 5-2484 ● *Newark, N. J. Ph. MArket 4-3650
DISTRIBUTOR: CROSE-CURRAN LTD. — *Edmonton, Alberta Ph. 3-5135
● *Winnipeg, Manitoba Ph. SPruce 4-1851
*Warehouses in 5 locations

. . . the home stretch

Ahead of Schedule

Westcoast Transmission Company's 30-inch natural gas pipeline was completed about two months ahead of schedule.

The 800-mile system extends from Peace River gas fields to the International Border and to cities in British Columbia, across some of North America's most rugged terrain.

Bechtel had a major part in this development—so important in Canada's flourishing economy—having been manager of engineering and construction of the project and constructor of part of it.

BECHTEL CORPORATION

ENGINEERS AND BUILDERS FOR INDUSTRY

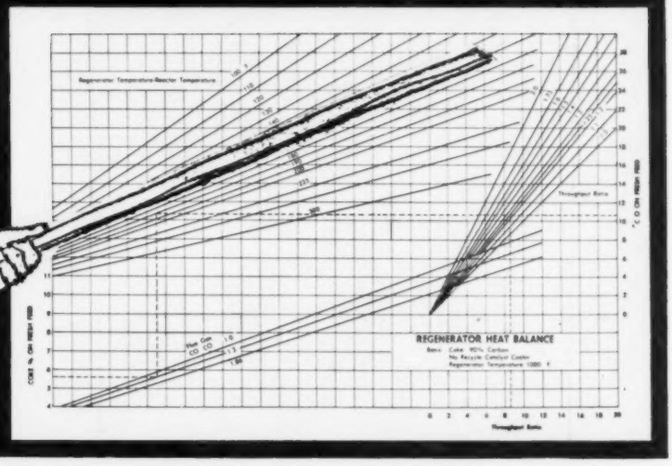
San Francisco • Los Angeles • New York • Houston

CANADIAN BECHTEL LIMITED

Toronto • Vancouver

BECHTEL

BORN BUILDS BETTER HEATERS



For one thing BORN builds nothing but heaters . . . heaters for every process heating requirement. For over forty-two years BORN has specialized in this field and as a result BORN HEATERS are known for their close control, economical, trouble-free operation plus exclusive safety features not found on any other heaters. During this time BORN HEATERS have built a reputation for producing day after day with no expensive "down-time" for frequent servicing and repairs.

No wonder BORN HEATERS are specified time and time again by clients whose names are the Who's Who of the Oil Industry.

For the complete story on a BORN HEATER to fit your needs, write, wire or call your BORN representative. He's anxious to serve you.

BORN Engineering Company

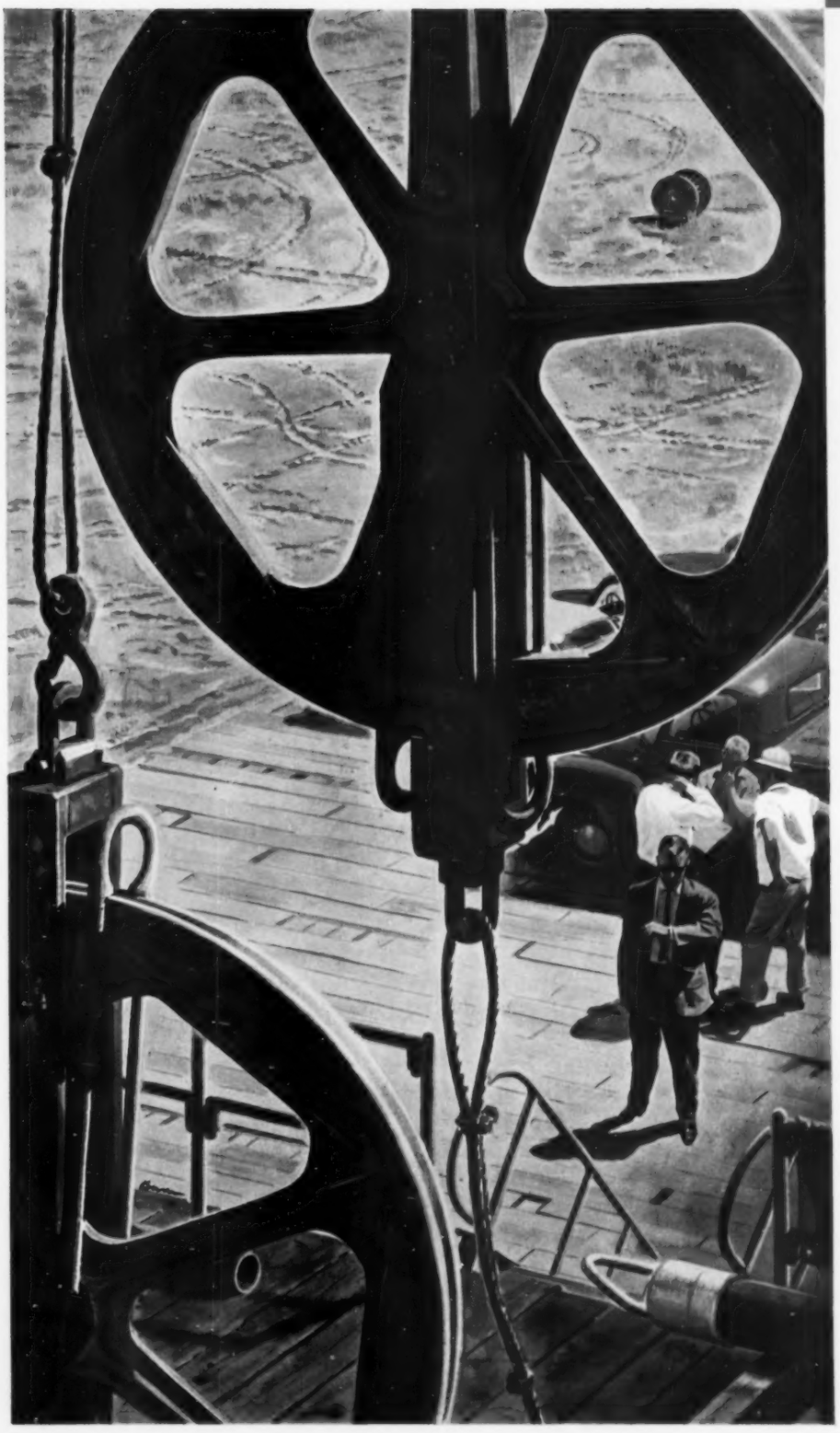
Manufacturers of Direct-Fired "UPFLO" Heaters

TULSA, OKLAHOMA

BRANCH OFFICES:
Denver, Colo.; Houston, Tex.; Los Angeles, Calif.; New York, N. Y.; Shreveport, La.

FOREIGN OFFICES:
Canadian Brown Steel Tank Co., Ltd.
Brandon, Manitoba, Canada
Brander & Cia. S. A.
Tacuari 318
Buenos Aires, Argentina
Premafrance
26 Boulevard Gouvion St. Cyr
Paris 17, France

With Magcobar on your well



logging can begin on time, on schedule to save you money

A well-planned and executed mud program can save money all along the line. For example, when the mud is properly conditioned for logging, with the proper weight, the right viscosity, correct gel strength, etc., logging proceeds on schedule without costly delay. Your well is ready for logging as soon as the desired depth is reached. When desired, mud resistivity can be controlled to improve log interpretation. To help you in both the planning and the execution of your mud program, the Magcobar team will work right along with you.

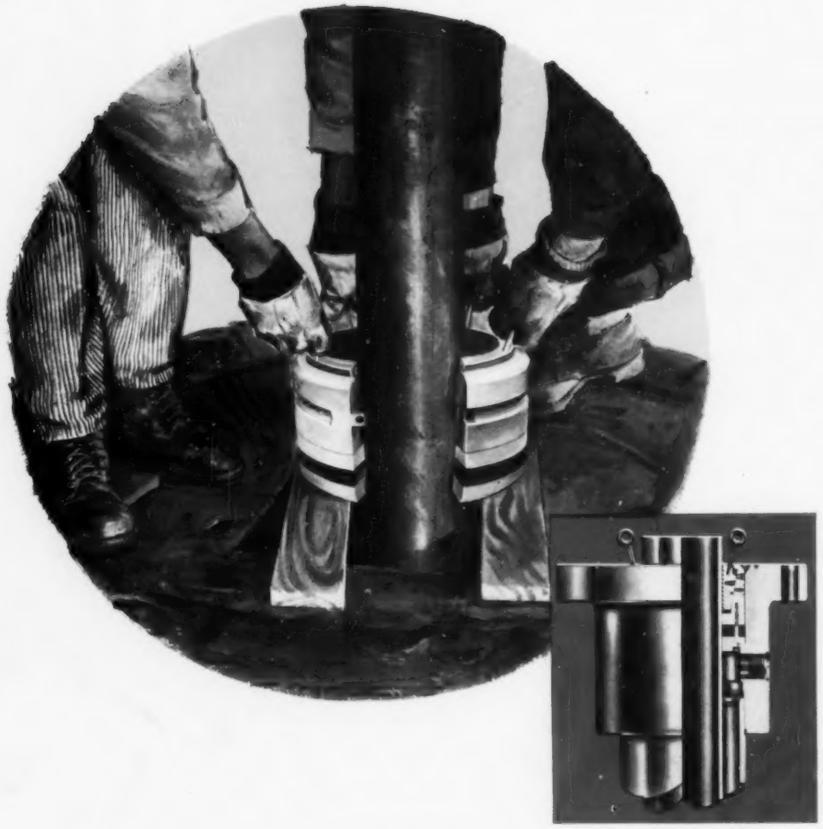
Magcobar's complete drilling mud service brings you the right drilling mud chemicals for each foot of hole. Magcobar's mud engineers are the best trained and best qualified in the mud industry. The full facilities of Magcobar can help you to lower the over-all cost per foot of hole drilled. Plan now to make full use of Magcobar's *complete* drilling mud service on your next well.

Magnet Cove Barium Corporation
Houston, Texas

Magcobar
Complete
DRILLING MUD SERVICE

57-101

THE O·C·T C-20 CASING HEAD



lets you work in *Safety*

Regardless of how or when you decide to install the O-C-T "C-20" Casing Hanger . . . before cementing, after cementing, through preventers, under preventers, or at any time in case of stuck pipe . . . you can improve the safety of your completion operations and save hours of expensive rig time due to the flexible, simplified O-C-T installation procedure.

Let your O-C-T Representative give you all the details or write for complete information. Available through more than 700 supply store locations.

The first quick-setting, positive-sealing well head designed especially to eliminate open hole hazards in medium depth wells, the O-C-T "C-20" Casing Hanger can't forget to seal . . . because the sealing element, slip bowl and slips are assembled as a single unit that may be wrapped quickly around the casing, latched and dropped into place, eliminating the possibility of individual parts being installed incorrectly.

FOR DUAL COMPLETIONS *Specify* O·C·T

The compact Oil Center Tool Company Christmas Tree assembly provides a safe, strong and practical means to economical dual completions.

If you are considering dual completions, it will pay you to check the features and get the full story of this O-C-T Dual Completion Assembly.

O·C·T

OIL CENTER TOOL CO.

A SUBSIDIARY OF FOOD MACHINERY AND CHEMICAL CORPORATION

Export Representatives: South America — East West Oiltools, C. A., Del Lago Hotel, Maracaibo, Venezuela. Address Export Inquiries for All Other Countries to P. O. Box 3091, Houston, Texas.

ASK US FOR MORE INFORMATION